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Minerals in the Common Market

BRITAIN'S decision to apply for membership of the Common Market has been favourably received by both the Six and the Seven, while the reaction of most Commonwealth countries, if scarcely enthusiastic, has not been wholly unsympathetic. Mr. Macmillan has given emphatic pledges that the Commonwealth will be consulted at every stage and that Britain will not join the Community unless the interests of her partner countries, as well as those of her own farmers, are safeguarded. At the same time, he has made it abundantly clear that, consistent with these assurances, the British Government will do everything within its power to bring the negotiations to a successful conclusion, and that he visualises a mighty Commonwealth of Europe with Britain as a leading member. Since Britain's accession would almost certainly be followed by that of other members of the Seven and also of Eire, thereby transforming Europe into an economic unit comparable in size to the United States and the U.S.S.R., the importance of the pending negotiations can scarcely be overstated.

One of the chief points made by the Prime Minister is that Britain in isolation would be little use to her Commonwealth partners; hence her Commonwealth and European interests are basically complementary rather than conflicting. While the detailed negotiations will involve hard bargaining, the U.K. Government is evidently convinced that with goodwill on all sides the hurdles may not be insurmountable. Presumably it is reasonably confident that, without watering down the basic principles of the Treaty of Rome, the Six would be prepared to help Canada's exports of raw materials by changes in the external tariff, to offer free entry for a few key commodities such as tea, to regard New Zealand as a special case, and to offer the Commonwealth's African territories the same terms of association as those offered to French African territories.

In the latter context it is noteworthy that the tariff cuts agreed on under the accelerated timetable for the Common Market are applicable to the associated countries, whose products, in general, have not been subject to quantitative restrictions except in France. Now France, too, has opened up import possibilities for all the associated countries. Moreover, the Common Market Treaty makes provision for economic and social aid to the associated countries, for which purpose an Overseas Development Fund was set up in 1958. For the underdeveloped countries of the Commonwealth, association with the Common Market could lead, therefore, to a broadening rather than contraction of the flow of foreign aid.

On the assumption that by joining the Common Market Britain would give a shot in the arm to her own economy and a further stimulus to world trade as a whole, the Commonwealth's mineral producers have little, if anything, to lose and perhaps much to gain from such a development, since most raw materials already enter the Common Market, as they do Britain, duty free. As an indication of the potential impact of the proposed link-up on the

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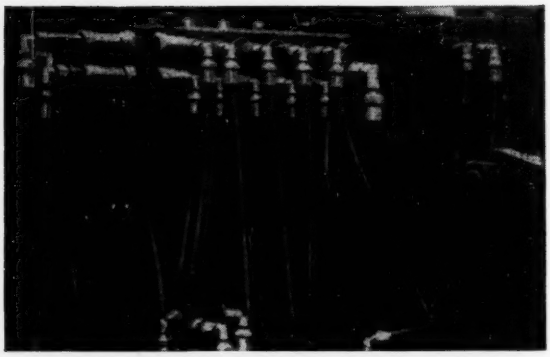

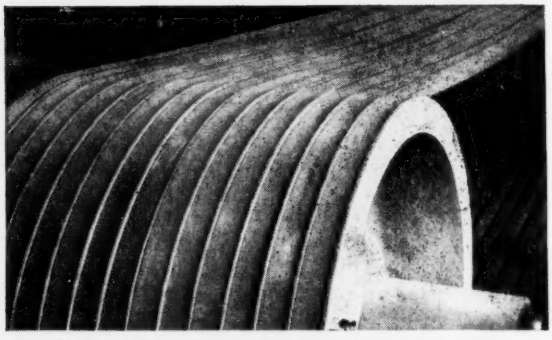

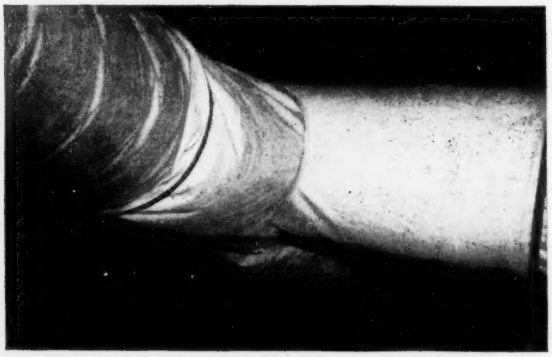

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consumption of minerals, it can be stated that between 1952 and 1960 steel deliveries across internal frontiers of the Common Market countries increased by no less than 475 per cent. This, of course, has led to very rapid expansion of steel output in the Community countries, with consequential rise in demand for the associated metals and minerals.

The market for copper ore is to all intents and purposes free, but as with iron ore the trade pattern is influenced by ownership of production facilities. According to The Economist Intelligence Unit, participation in a European association could add at least 2 per cent. to the U.K.'s gross national product by 1970, with a corresponding gain in U.K. copper consumption. Commonwealth sales to other European countries might also benefit. E.E.C. is the Commonwealth's chief market for lead ore and imports almost as much zinc ore from the Commonwealth as from its own overseas and associated territories. As a market for nickel Western Europe is now as large as the U.S.A.

While most minerals exported in unprocessed form escape any tariff in either Britain or the Common Market countries, some hard bargaining may be required in regard to a number of metals. Until positions have been established in the negotiations, little good purpose can be served by speculation as to the future outcome. In general, however, it seems reasonable to anticipate that U.K. participation in the Common Market on terms which would permit the Commonwealth to retain its current share of the U.K. market would, by raising the rate of economic growth and hence the demand for metals, tend to cancel out any loss arising from the E.E.C. tariff. So far as aluminium is concerned, the Rome Treaty provides for the tariff-free entry of this metal from any of the plants set up in associated African territories ; hence free entry into the U.K. from the Commonwealth should also be possible.

Tin presents no problems, since the smelting countries in Europe import tin ore from overseas and the rest of Europe imports metal mainly from them. The principal Commonwealth producers of tin ore, Malaya and Nigeria, would, of course, benefit from the rising level of industrial activity arising from a link-up between Britain and the Community.

While the Central African Federation would be unaffected so far as its principal export — copper — is concerned, fears have been expressed that its growing metal processing industry could be hit, since such products as ferrochrome and alloys, lead and zinc metals, iron and steel, cadmium metal and cobalt metal, would all have to cross a tariff wall. This situation, it is feared, could mean that the Federation would be pegged to being a producer of primary materials. In this connection, however, it is noteworthy that the Common Market Treaty gives the associated countries the right to retain customs duties on exports from the Six for development or industrialisation needs. Thus a precedent exists for the solution of this particular problem.

While world-wide difficulties in coal have not been conducive to expanding trade, either inside or outside the Community, it is possible that our own coal industry might benefit from British membership of the Common Market, which would presumably bring an end to the present penal tariff on British coal which is levied on quantities over 600,000 tons entering Germany in any one year. On the other hand, the National Coal Board would no longer be in a position to offer coal for sale in the E.C.S.C. at a price below the British domestic price. The industry is watching the situation very carefully. The possibility of exporting some 5,000,000 tons per annum to the E.E.C. countries is foreseen, but as yet it is too early to say with any degree of assurance what the prospects might be.

The question of whether South Africa should seek associate membership of the Common Market appears to have been given official consideration even before she left the Commonwealth. Whatever the decision, it would appear that South Africa has little to lose if Britain goes into E.E.C., since her exports of gold, diamonds and base minerals, as well as her important wool industry, would be unaffected.

Uranium producers in South Africa, as in Canada and Australia, might feel some anxiety as to the possibility of an association which could give Euratom access to the huge stocks held by the U.K. A.E.A., but until the supply position has radically altered it will obviously be cheaper for Euratom to buy its requirements in the open market.

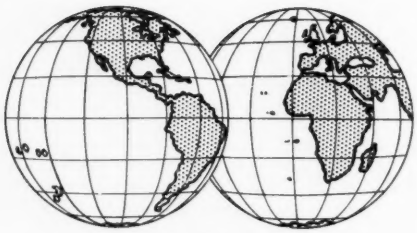
CHILE'S NEW PROPOSALS FOR MINING EXPANSION

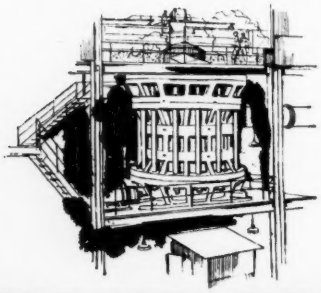
Proposals for new measures to supplement Chile's existing copper mining legislation, passed in 1955, are to be incorporated in a ten-year development programme. As outlined recently by the Mining Minister, Sr. Enrique Serrano, and subsequently published in the Chile Press, the proposed legislation calls for a progressive increase of 15 per cent in mine output every three years and will also compel Anaconda and Kennecott to refine in Chile all the copper they mine in the country. At present these two companies produce a combined total of about 550,000 tonnes a year in Chile, of which about half is refined locally and the balance shipped as blister.

Other aspects of the new mining legislation now being considered include increased control by the Chilean Government's Copper Department over the marketing of copper and increased domestic fabricating of copper within the country, so that fabricated copper products, rather than refined copper, could be exported.

The proposed new laws have apparently come as a surprise to Anaconda and Kennecott, who have plans for investing a combined total of some $325,000,000 in the country (*vide The Mining Journal*, July 21, 1961, p.59). If approved, these investments would increase Chile's copper output by 100,000 tonnes, but for the past eighteen months the companies have been negotiating for government guarantees to secure them. Earlier this year the Chilean Finance Minister stated that Kennecott planned to invest $200,000, Anaconda $100,000 and Cerro de Pasco $100,000, a condition of the expansion being that there should be no change in the taxation set-up over a fixed period.

Kennecott has refused to comment on the proposals, but Anaconda's views on the proposed legislation were forcefully expressed by the president of the company, Mr. Charles M. Brinckerhoff, in a press conference convened for the purpose in New York. Mr. Brinckerhoff produced a translation of portions of Sr. Enrique Serrano's address showing that Anaconda had invested $170,000,000 in the last five years to increase the output of Chuquicamata by 50,000 tonnes and to bring the 90,000-tonne El Salvador mine into operation. He expressed the opinion that the Minister's proposal to compel U.S. mining concerns to invest enough capital in Chile to increase their output by 15 per cent every three years might be technically unfeasible and that, from the point of view of attracting new investments, it might not be in Chile's best interest. Mr. Brinckerhoff also repeated his previous announcement that Anaconda was planning to build a $15,000,000 - $18,000,000 electrolytic refinery at El Salvador to refine all that mine's output and added that approximately 63 per cent of Chuquicamata's output was currently refined in Chile. He made the further point that, according to the Minister's speech, Anaconda had been investing more than the 1 per cent of gross profit required by law in workers' welfare.





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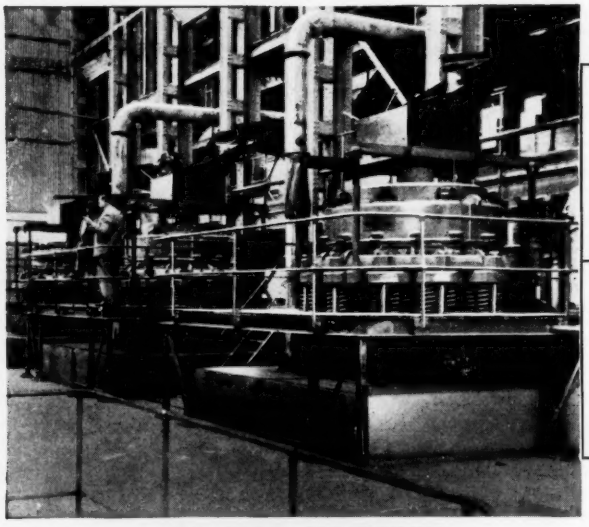
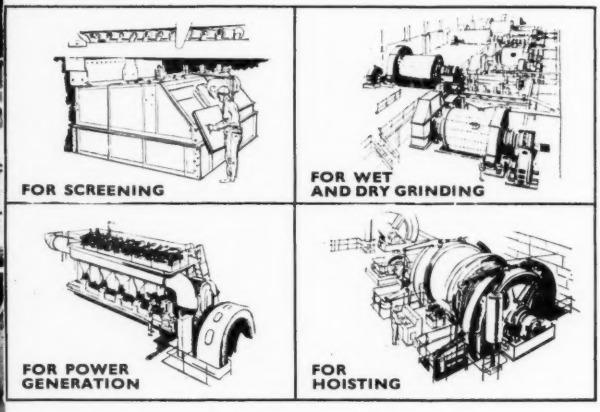


Three of five Symons Cone Crushers serving a Northern Rhodesian mining operation.



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Statistics were produced at the conference which showed that during the past ten years Anaconda had actually invested more than $253,000,000 in its Chilean operations, comprising some $208,000,000 in plant and equipment and some $45,000,000 in social welfare. Of this total, nearly $170,000,000 had been invested since 1956. The statistics also showed that Anaconda's mine output in Chile had been increased from 222,745 tonnes in 1950 to 341,638 tonnes in 1960 and 380,990 tonnes this year, based on the current rate of production. It might be added that Anaconda's mining properties in Chile have been operating at 10 per cent below capacity since early in the current year, to help in averting a world surplus of copper.

Having regard to the figures given to the meeting, which are impressive enough by any standards, one can well understand Anaconda's astonishment that any compulsion should be regarded as necessary by the Chilean Government.

Yet another disagreeable surprise for Anaconda and Kennecott was a bill approved by the Education Committee of the Chilean Chamber of Deputies, which adds 5 per cent to the income taxes paid by the two companies. Proceeds of this tax would be used to finance new school construction.

Chile's proposed legislation, so hard to reconcile with the vast programmes of expansion already projected by the two major copper mining companies, is perhaps in the nature of a political safety valve against Leftist pressure and to some extent symptomises the unhappy relations currently existing between the United States and the Latin American countries. "What is really important," states a recent article by Senator Francisco Bulnes, a member of the Conservative Party and a supporter of President Alessandri's administration, "is not the loans that the President of the United States proposes to make us. The truly important thing would be that that country should decide to deal with us in terms of justice, paying us for our raw materials prices in proportion to those we must pay for its manufactured articles." The article goes on to emphasise Chile's determination not to continue in the role of a mere producer of raw materials. Chile must have its large mines exploited intensively and its copper processed in the country.

In the present political climate of Latin America, it is more than doubtful whether the U.S. companies, without throwing economic prudence to the winds, could go fast enough to satisfy Chilean aspirations. On the other hand, U.S. capital for the expansion of the copper industry is of such critical importance to Chile that the government is hardly in a position to risk wielding too big a stick, even to such willing horses as Anaconda and Kennecott. Nevertheless recent speeches by Conservative Party leaders have toyed with the idea of nationalizing or expropriating the U.S.-owned copper mines, and it has even been suggested that the U.S. government should advance Chile the funds to do so! Now a Bill authorizing the expropriation of all the big copper producing plants has been submitted to the Senate by the Socialist Party in opposition. For expropriation purposes it fixes the value of the plant at $209,000,000, which would be payable over 30 years at 3 per cent interest. Such a policy, however, would be so inimical to Chile's own interests that it could hardly be considered very seriously by any responsible government.

Answering some of the criticism voiced by Mr. Brinckerhoff, the Minister of Mines emphasized that companies which had responded to the "New Deal" copper law of 1955—among which he instanced Anaconda—"had no problem", and he also stated that, when necessary, production would continue to be adjusted to market conditions as at present. At the same time, he reiterated the government's determination that the large mining companies should become Chilean corporations operating fully under Chilean laws.

Meanwhile Anaconda has another labour dispute on its hands at Potrerillos and El Salvador and there is the prospect of a sympathetic strike at Chuquicamata and El Teniente if agreement is not quickly reached. The company's offer of a 7 per cent wage increase has been rejected and it is evident that, whatever the outcome of the dispute, the settlement will add to the ever-rising burden of production costs.

WILL TSHOMBE NEGOTIATE?

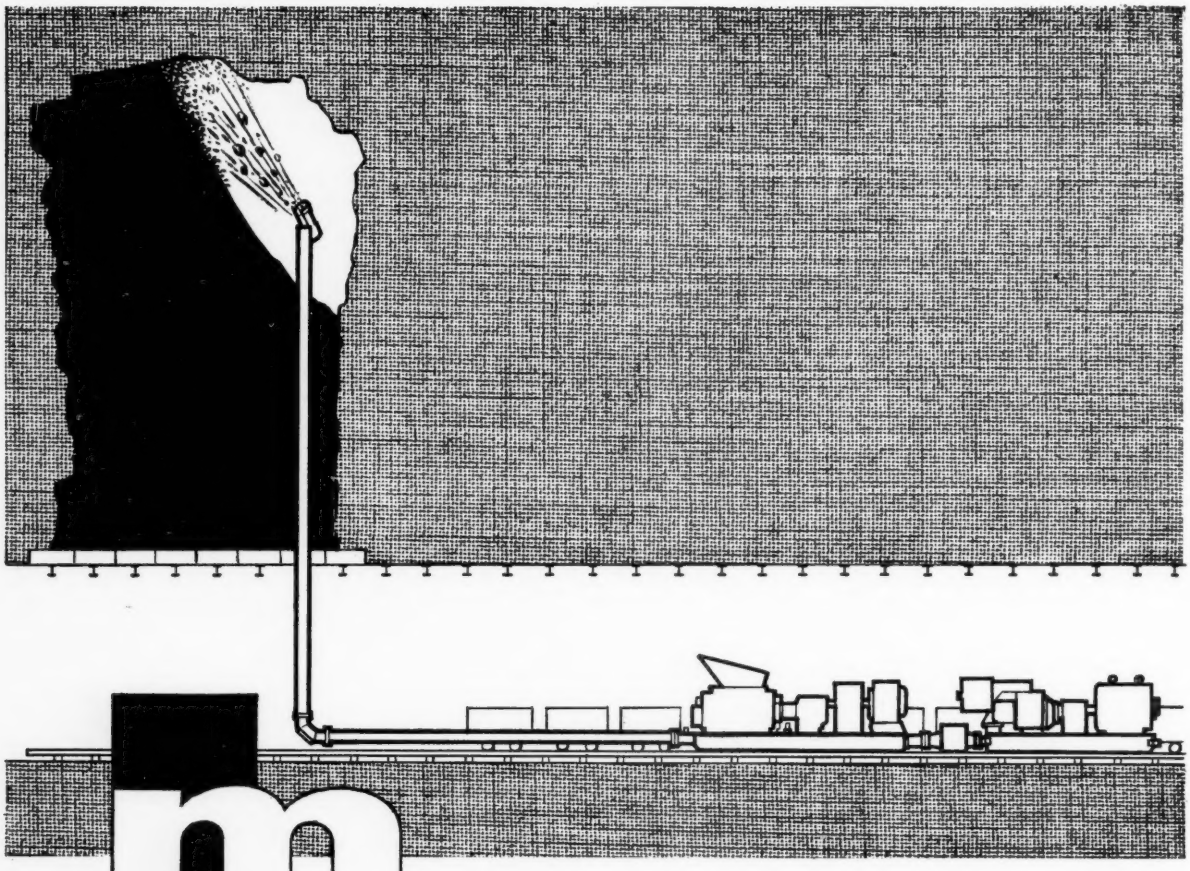
The Congo Parliament, meeting in secret session in Leopoldville, has confirmed M. Cyrille Adoula as Prime Minister and Minister of Defence. M. Antoine Gizenga, formerly deputy to the late Patrice Lumumba, is Vice-Premier. While this development is to be welcomed, in principle, as an important step forward in the direction of Congo unity, the most critical issue of all has yet to be resolved, namely the future of Katanga and its revenue from mineral production of about $50,000,000 a year.

Unless the Congo Republic can divert some of Katanga's revenue into its own coffers, its prospects are bleak indeed. It was hardly surprising, therefore, that two of the key points in M. Adoula's programme should be "reduction of the Katanga secession" and a demand for the repatriation of the huge shareholding in Union Minière formerly held by the Katanga Special Committee, the liquidation of which has been delayed because of the rival claims of the Leopoldville and Elisabethville Governments.

M. Adoula has threatened, if necessary, to bring Katanga back into the fold by force and it has been officially stated that the U.N. would not oppose a military action undertaken by a legal Congolese Government for such a purpose. Within Katanga itself, however, both political and economic pressures have arisen which might impel M. Tshombe and his advisers to adopt a less intransigent attitude towards reunification. It is conceivable, therefore, that this might yet be accomplished without civil war. Katanga's position was discussed in our issue of July 21, 1961, p.57.

From the standpoint of the Katanga mining interests, a peaceful and permanent solution to the Congo's political troubles is obviously to be desired, provided that the authorities concerned have a sympathetic understanding of the industry's needs. Against the benefits of Congo unity, however, must be set the possibility that a Government situated in remote Leopoldville might be unrealistic in its approach to mining taxation and might fail to appreciate the paramount importance of a favourable climate for investment and expansion. There is, too, the danger that an excessive proportion of the revenue from mineral production might be diverted to the Treasury at Leopoldville without due regard to the requirements of Katanga and the mines themselves.

All the cards are by no means in M. Adoula's hands, however, and M. Tshombe is still in a position to negotiate from considerable strength. U.N. headquarters in the Congo has announced that the Katanga President will be given full protection if he decides to visit Leopoldville for discussions, and it was further reported that M. Tshombe himself had raised the possibility of U.N. good offices for such a meeting. Although Union Minière's shares fell sharply on the news of the new Government in Leopoldville and of M. Adoula's programme, the present situation is not without its encouraging elements, though the negotiations, whatever their outcome, are certain to be long and arduous.



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Refining Crude Aluminium by the Subhalide Reaction

A PAPER entitled "Refining Crude Aluminium by the Subhalide Reaction" has been published by the Bureau of Mines, U.S. Department of the Interior, as *Report of Investigations* 5773. The authors are Leland A. Yerkes and Oliver C. Fursman.

One of the Bureau of Mines programmes, of which this investigation is a part, is to develop practicable methods of producing aluminium from non-bauxite resources. In one phase of the programme at the Albany Metallurgy Research Centre, Albany, Oregon, in September 1951, research was begun on the recovery of aluminium from aluminium-silicate materials such as clay, kyanite and pyrophyllite. During the first four years the work consisted of smelting these materials to form aluminium-silicon alloys, the purity of which depended on the composition of the raw materials because most of the contained oxides were reduced in smelting. The recovery of aluminium from crude aluminium-silicon alloys was also studied. In one method used, aluminium was separated by treating the crude alloy with molten zinc, filtering to separate the low-melting zinc-aluminium alloy, and evaporating the zinc. Variations of this process are being studied by the Bureau of Mines.

The subhalide reaction offers another possible means of refining crude aluminium. In this method, aluminium in the crude material reacts at low pressure and high temperature with vapourised aluminium trihalide, forming aluminium monohalide vapour, which reverts to aluminium and aluminium trihalide when cooled. In October 1955, the Bureau of Mines instituted investigations to determine the feasibility of the subhalide process for extracting relatively pure aluminium from crude aluminium-silicon alloys produced by smelting clays or other aluminium-silicate materials.

In the investigation here described, the best materials and design for the apparatus and also optimum operating conditions, including temperature, pressure, vapour flow rate, and composition of alloy charge were studied. The only halide used in this investigation was aluminium trichloride. The crude aluminium-silicon alloys used as the principal raw material contained from 21.9 to 36 per cent aluminium, and significant quantities of iron and titanium. These alloys were produced by direct electric smelting of clays.

Graphite tubing that was heated by an induction coil proved to be satisfactory material for the laboratory reactor chamber. Enclosed in an insulated glass or quartz pipe, the reactor was used in both vertical and horizontal positions with various baffle and tray arrangements for directing the trihalide vapour both over and through the alloy. Aluminium trichloride vapour was generated in the sublimer at one end of the glass pipe, passed into the reactor where contact was made with the crude alloy, and aluminium monochloride gas was formed. When the gaseous mixture of aluminium monochloride and unreacted trichloride passed out of the reactor and entered the condenser, the gases were cooled to 900 degrees C. or less, causing the monochloride to disproportionate into aluminium and aluminium trichloride vapour. The aluminium was deposited on the condenser walls while the aluminium trichloride vapour was carried out of the condenser and into the opposite end of the glass pipe where it solidified on the cooled copper coils.

Test results showed that pressure in the reactor must be 25 mm. of mercury or less for satisfactory production of refined aluminium in the temperature range 900 to 1,200 deg. C. Increase in pressure caused decrease in production until at atmospheric pressure no product was obtained. In tests at low pressures, the reaction index (grammes of aluminium recovered per 100 grammes of aluminium trichloride used) improved directly with increase in temperature. Usually, the production of refined aluminium (reaction index) increased as the aluminium content of the crude alloy charge was increased.

Aluminium products having less than 0.1 per cent of silicon and iron each were produced in some tests. Spectrographic analysis indicated the presence of gallium, lead, nickel, zinc, copper, magnesium, and titanium, ranging from 0.001 to about 0.1 per cent. The highest aluminium recovery (64.3 per cent) was obtained in a test at 1,100 deg. C. and at a maintained pressure in the reactor of about 6 mm. of mercury; in this test the aluminium trichloride was passed through the charge twice (two-pass test). Crude aluminium-silicon alloy that had been subjected to five two-pass tests at 1,050 deg. C. was reduced in aluminium content from 36.0 to 8.1 per cent. Overall aluminium recovery accounted for 61.6 per cent; the remainder was unaccounted for. The maximum aluminium trichloride vapour converted to monochloride during any one pass through the reactor was 24.7 per cent.

Refined aluminium was also successfully produced from commercial aluminium shot. One attempt to produce aluminium from clay by the subhalide reaction ended in failure.

The authors recommend that further research should be conducted to determine whether the subhalide process can be developed into an important tool for the aluminium industry. This research should include studies on generation and rate of flow of aluminium trichloride vapour, time of contact between vapour and crude alloy, and degree of refining of the alloy. Before the process can have far-reaching effects in the aluminium industry, equipment in which the reaction can be carried out continuously must be developed. Although graphite tubing proved to be satisfactory material for the reactor chamber in the laboratory-scale apparatus, other types of materials must be considered for larger plant equipment—materials that will withstand the operating conditions proved in this investigation to be required for practicable application of the aluminium monochloride reaction.

Research and development of a method of by-passing the alumina stage in the reduction of aluminium have also been in progress in other countries for a number of years. In recent times the most aggressive work in this field has been done by Aluminium Ltd. of Canada and by the joint efforts of Péchiney and Ugine in France.

The electrochemical method under investigation by Aluminium Ltd. is understood to be based on the work of P. Gross at the Fulmer Research Institute Ltd., Stoke Poges, Buckinghamshire, England, on the subhalide distillation of aluminium. Final tests are to be carried out in Canada on a pilot plant of about 6,000-9,000 tons capacity, which is at present under construction. Aluminium Ltd. has licensed its Japanese subsidiary, Nippon Light Metals Co. to go ahead on the same lines.

Péchiney-Ugine has constructed and placed in operation at Noguères, in south-west France, a pilot plant of some 5,000-6,000 tons capacity where the process can be studied under actual operations such as would be encountered in a commercial plant.

Commonwealth Conference—VIII

Rock Mechanics Research in South Africa—II

The article appearing herewith is condensed from a paper presented at The Seventh Commonwealth Mining and Metallurgical Congress convened in Southern Africa. It is one of a series in which papers of particular interest are offered in abridged form

PRIOR to the investigations of the C.S.I.R.'s research team, the view was generally held that the greater the rate of face advance, the less the incidence and severity of bursts. In 1956 an analysis was made of the influence of the rate of face advance on the rockburst incidence in the E.R.P.M. for an area of 558,000 fathoms stoped; the results are:

Influence of Rate of Face Advance on the Rockburst Incidence in the E.R.P.M. During the Years 1948-1955

Face Advance (feet per month)	*Square Fathoms Stoped*	*Bursts*				
		Slight	*Severe*	*Total*	*Percentage Severe*	*No. bursts per 1,000 sq. fms. stoped*
0–14	256,000	212	174	386	45%	1.51
15–30	302,000	179	127	306	41%	1.01

The part played by the span on strike between mining faces in relation to rockbursts is extremely hard to assess. We are aware that the percentage of ore extracted is important, but what is the particular effect of span? The Hercules longwall faces of the E.R.P.M. shown in Fig. 3, gave an excellent opportunity for studying this question.

The rockburst incidence for different spans was studied and the results suggested that the incidence reached a maximum with the span at 700 to 900 ft. and again at 2,300 to 2,500 ft., with a minimum at 1,500 to 1,700 ft. for the conditions prevailing in this particular area. It would be wrong to infer that these figures are generally true for deep level mining on the Central Witwatersrand, but they nevertheless indicate that a straight line relationship does not exist between span and incidence of bursts. Another fact that emerged from the investigation was that no significant relationship appears to exist between span and severity of bursts.

Of even greater difficulty is the obtaining of data to demonstrate clearly what effect support has on the incidence of rockbursts. On the Kolar Gold Fields in India, where bursts can be very severe, the belief is universally held that support must be as complete and as incompressible as possible, and should be installed as soon as possible. We on the Witwatersrand are still open-minded on the question. We believe that support near the face should be sufficient to control the effects of a rockburst, but are not yet able to assess whether or not it is better to have a large amount of support in the stoped areas. It may be argued that if the hanging in the back areas of the stope is allowed to settle quickly on to the footwall, the fracture zone will increase in size, more fractured ground will rest on the footwall, and there will be less load on the solid abutments.

A research project has been started at the Blyvooruitzicht and West Driefontein mines under the aegis of the University of the Witwatersrand with the object of trying to ascertain the effect of support on abutment pressure; but the variables are so many that the gaining of precise knowledge will be extremely difficult.

The Mechanism of Bursts

The existence of a fracture zone around mining excavations in hard rock at depth has been adequately proved, and it now remains to discuss the mechanism of fracture and particularly of bursts.

In the process of stoping, ore is mined out on the plane of the reef; the stopes are supported on timber or waste rock. However, the support is not brought in immediately after the blast and, moreover, it is compressible. The hanging wall, therefore, sags, as a result of which fracture in the form of separation between sedimentary layers and tensile failure of beams takes place. The footwall strata, too, may bulge and fracture, for, with the relief of stress, they tend to expand and buckle into the excavation. In addition, shear failure resulting from the high rock pressure at great depth, intensified by the fact that an excavation has been made, may also occur in hanging and footwall.

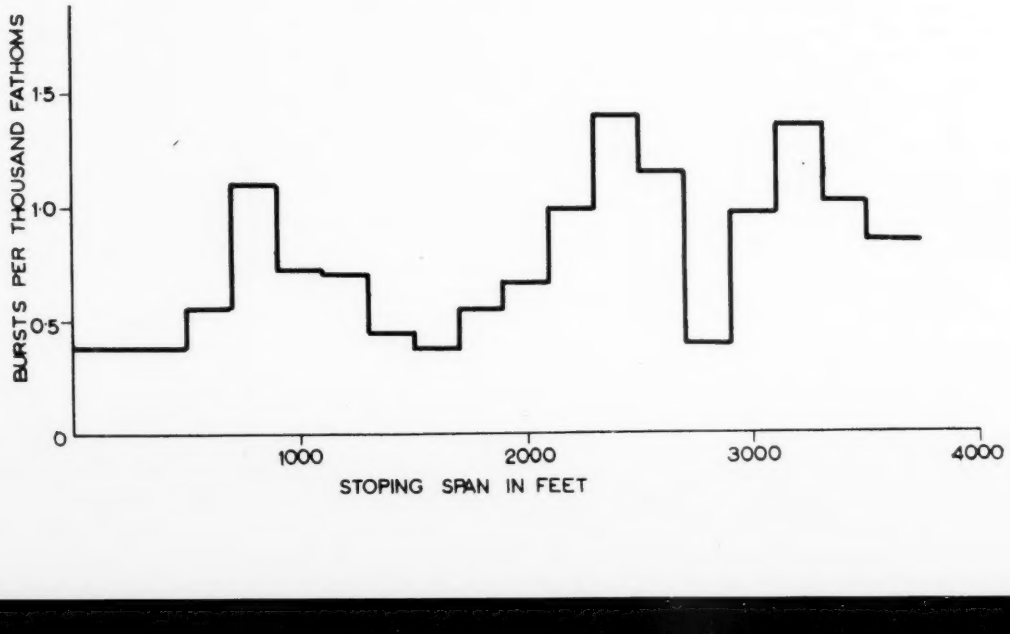

Fig. 3: Influence of the strike span between longwalls on the incidence of rockbursts

By

F. G. Hill

TECHNICAL DIRECTOR, RAND MINES LIMITED

and

H. G. Denkhaus

DIRECTOR, NATIONAL MECHANICAL ENGINEERING RESEARCH INSTITUTE OF THE SOUTH AFRICAN COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH

This type of fracturing, accompanied by movement—both in hanging and footwall—usually occurs without violence; closure in the stope is under control, and the fracturing that takes place is a series of continuous breaks that do no damage.

The fracture zone formed in this way thus consists of blocks or slabs of varying size and shape. It is de-stressed in the sense that it is relieved from the stress due to the weight of the superincumbent solid rock; due to the weight of the blocks or slabs of which it consists, however, the fractured mass tends to sag further until wedging is achieved between the individual blocks as well as between the blocks and the solid ground at the boundary of the zone. As a result of this wedging, vertical and lateral thrust is exerted from the fracture zone on the solid ground and a new system of stress is built up in the fracture zone itself. A system kept in a stable position as a result of such wedging—and to a certain degree also as a result of friction along the fracture planes—has been termed a "*voussoir* arch". The abutments of these arches are at the face and at places where the hanging has settled on the footwall.

So-called "intradosal bursts" may originate in the fracture zone. They are a local collapse of a *voussoir* arch and therefore occur at places where the hanging tends to become unstable as a result of the presence of dykes, faults or other disturbances in the mined-out area. They can also occur at the *voussoir* arch abutments.

Generally speaking, however, the fracturing that takes place above or below the stope is gradual and under control.

Increased Stress from Stoping

The process of stoping, which enlarges the excavation, also however causes ever-increasing stress in the intact solid ground, mainly ahead of the face where an ever-increasing weight of superincumbent strata has to be supported. As has been shown earlier, this increasing stress manifests itself in a deep-level mine by the appearance of fracture planes in hanging and footwall; these fracture planes we know to appear well ahead of the face, a distance of 10 to 20 ft. being normal. The solid ground at the boundary of the fracture zone is under very high stress—much higher than the average stress in the solid ground further away.

This concept of a zone of increased stress ahead of fractures has been demonstrated experimentally by tests carried out in stopes of the E.R.P.M. at depths of the order of 9,000 ft. Series of holes were drilled from a pre-developed drive ahead of an advancing face; the change in stress was derived from the change in diameter of the holes as measured by means of strain cells. As the face approached each cell in turn the stress was found to grow until the face was 15 to 20 ft. from the cell. The cells then ceased to function, indicating that they had been crushed—the fracture zone had reached the cells.

This confirmation of a zone of increased stress at the boundary of the fracture zone enables us to postulate the following theory on the mechanism of the so-called "extradosal" type of burst:—

Around the fracture zone of any excavation at depth are, in certain places, zones of intensified stress. The zones of maximum stress lie ahead of and move with the advancing face. In the case of stoping, the line of maximum stress in the plane of the reef is probably smooth and does not follow the line of the faces slavishly; it may be nearer to the face in some places than in others.

Due to this high stress, which is greater than the compressive strength of the rock, the ground ahead of a moving face is fracturing all the time; a seismic instrument installed underground has recorded these small fracturings, and showed, incidentally, how they multiplied immediately after a blast. As long as successive small fractures are taking place regularly and continuously, the working place would seem to be reasonably safe; but whenever there is interruption to regular fracture due, for example, to lack of homogeneity in the ground, such as faults, dykes or varying strengths of strata, stress may accumulate and bursts may occur. Abnormally high stresses may also be present in certain abutments such as island remnants or cape abutments. Here, too, we may expect fracture and hence release of elastic energy to be large-scale and violent; in other words conditions then exist which tend to bring about pressure bursts. These extradosal bursts, therefore, originate in the solid ground and cause a sudden enlargement of the fracture zone.

High stresses may also develop in the hanging wall or footwall of a stope if strong strata arrest the development of fracture. Should these high stresses eventually break the strong strata, the underlying rock will be "punched"—as discussed earlier in this paper. This is an extradosal burst which may manifest itself in the stope as an "intradosal" incident.

Malaya Produces More Tin

A TOTAL of 27,130 l. tons of tin-in-concentrates was produced by the mines of the Federation of Malaya in the first six months of 1961, an increase of 169 tons over the preceding six months and 2,112 tons over the first half of 1960. The output for the first half of this year is the highest for any six-months period since 1957, and closely approaches the annual rate of 55,000 tons for 1961, predicted by Mr. D. R. Mitchell in his presidential address to the F.M.S. Chamber of Mines, in May last.

It is significant that in the three months to June 30, the output at 13,988 tons was appreciably higher than the 13,142 tons achieved in the first quarter. Concentrates delivered by the mines to the smelters during the six months totalled 27,811 tons in tin metal content, with the result that mine stocks of concentrates further fell from 46,134 piculs at December 31, 1960 to 30,146 piculs on June 30, 1961, representing about 1,350 tons in tin metal content.

An increase in production combined with the higher market price for tin gave the Federation Government $M29,450,629 in export duty, against $M28,856,281 in the previous half-year. Tin metal exports, including metal produced from imported concentrates smelted in Malaya, totalled 40,177 tons, a drop of 4,624 tons on exports in the preceding six months, but an increase of 7,611 tons compared with the corresponding period of 1960.

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Metals Under U.N.'s Microscope

This study is extracted from "Commodity Survey 1960", issued by the United Nations, New York (Sales No. 61.IID.1, price $U.S.3.00; 21s. stg.). The survey examines developments on world markets for the major primary commodities during the period 1959/60 and analyses the post-war trends in production and consumption

THE primary commodity situation in 1959/60 was characterized by record rates of consumption, production and trade. The rise in prices induced by the recovery in demand, however, was short-lived and relatively feeble. Whereas the index of all major primary commodities moving in international circles declined by about 13 per cent between its peak in 1957 and its low point in 1959, there was a recovery of only 3 per cent between the first quarter of 1959 and the first quarter of 1960, and the index then began to drift downwards again. It is evident that the rise in demand during the recovery phase was not vigorous enough to absorb the output which would have been available if existing capacity to produce primary commodities had been fully utilized. In general, market conditions were influenced much more by the size of surplus stocks and by the restraints still being applied at mine or refinery to the output of petroleum, coal and most of the metals.

Though it is only recently that the imbalance between consumption and production has been dramatized by large surpluses and idle capacity, the genesis of the problem lies in the earlier post-war years when relatively high prices and rapidly growing demand stimulated investment in facilities to produce food, fuels and raw materials. For various reasons—economic, technological, military and other—the rate of growth in consumption was not maintained and in the second half of the nineteen-fifties demand trends have diverged continuously, and for some commodities increasingly, from trends in potential, if not actual, supply.

The main locus of the problem has been North America, the region of highest *per capita* consumption. It is here where the cereal surpluses have accumulated; it is here where rates of growth in consumption—and even more in imports—have fallen away most dramatically, even to the point of becoming negative in some cases. But the problem is by no means confined to North America. While idle colliery capacity, for example, emerged first in North America, the spectacular accumulation of pit-head stock coals of more recent years has occurred in western Europe.

The decline in rates of consumption in North America has left varying proportions of domestic capacity underutilized. An upturn in rates of growth, even when it comes, may well be reflected in import demand only after some delay and perhaps with a smaller amplification factor than in the early post-war period.

Changing Rates of Metal and Fuel Consumption

As indicated earlier, technological developments have tended to exercise a depressing influence on the consumption of most raw materials in the post-war period. As a result of economies, substitution and more efficient utilization, the rate of absorption of the principal minerals, for example, has lagged far behind the rate of expansion of manufacturing output. Between 1946-48 and 1958-60 manufacturing production outside the centrally planned countries almost doubled and the output of the metal-using industries increased by 125 per cent. Consumption of the major non-ferrous metals—aluminium, copper, lead, tin and zinc—aggregated at constant (average 1946-59) prices, increased by only 60 per cent, however, and consumption of the major fossil fuels by less than 40 per cent. Because of the continuing tendency for light materials to be substituted for heavier ones, the consumption of non-ferrous metals rose more rapidly by volume than by weight, but even the intake by volume in 1958-60 was less than double the 1946-48 figure.

The lag was most pronounced in the most advanced areas. In relation to manufacturing output, non-ferrous metal consumption—measured by weight or by quantum—rose less than 40 per cent in North America, and by about 70 per cent in western Europe. In relation to the output of the metal using industries, the rise was less than 30 per cent in North America and about 55 per cent in western Europe. There was a similar disparity in the relative increase in fuel consumption.

Three Post-War Phases

Within the framework set by this overall trend, there have been short-lived movements of varying intensity and duration. Most notable among these were the three distinct phases of the post-war period: the reconversion-reconstruction phase, the Korean conflict-rearmament phase, and the recent phase of normal growth punctuated by rapid cyclical swings. Within each of these phases there have been numerous sporadic influences—ranging from labour strikes to changes in government defence policies—which have had repercussions not only on the rate of current mineral consumption, but also on decisions regarding investment in mining and refining capacity.

The rate of increase of consumption in the first phase was held down by shortages of the minerals themselves and inadequacy of manufacturing facilities. It was also held down by a faltering in demand for durable goods in North America in 1948-49 and by the liquidity crisis that precipitated the devaluation of many European currencies in 1949. Investment in mines and smelters, however, went ahead. During this phase the average rate of growth of consumption was about half that of manufacturing output which, outside centrally planned countries, was about 6 per cent a year.

The second phase brought a considerable acceleration in the growth of demand, a considerable—if short-lived—rise in prices and a more general and more rapid increase in investment in new mineral producing capacity. Much of

the new investment, however, was related less to current rates of absorption than to the building up of stockpiles of strategic materials.

The transition to the more normal development of the third phase was marked by a considerable disturbance of the metal-using industries. The end of the Korean conflict brought a sharp cutback in activity in industries associated with military expenditure. This was followed in 1955 by an upsurge in demand for consumer durables—notably motor cars—in North America and for construction and other forms of investment in western Europe, but the resultant high level of metal absorption was not maintained. In North America two cycles, characterized by violent inventory movements, followed in quick succession and, although demand was better sustained elsewhere, the average rate of increase in metal consumption in the second half of the nineteen fifties was substantially below that registered in the first half.

This decline was accentuated by changes in the demand for purposes of inventory. One source of this change was the result of the impact of a technological revolution upon military strategy and requirements. With the shift away from conventional armaments, the metal content of a unit of defence expenditure was sharply reduced. This fact, and the reappraisal of the need for stocks in the light of the probable nature and duration of a future war, tended to alter the economic significance of stockpiles. In phase two, stockpile purchases had added appreciably to total demand; in phase three, such purchases declined to almost negligible proportions and in the case of some metals there was a net outflow. The demand for commercial inventories, though oscillating erratically with the cycles, was generally smaller than in the previous phase, reflecting the reaction of consumers to the changing balance between available supplies and current rates of absorption.

Lower Rate of Consumption

Notwithstanding the upturn in 1959-60, the average rate of growth of consumption in phase three remained below earlier rates for most metals. The contrast was sharpest in the case of lead, consumption of which actually declined in the second half of the nineteen fifties, but there was also a falling off in the rate of increase in the consumption of the other non-ferrous metals: even in the case of aluminium, absorption of which recovered sharply in 1959 and 1960, the average rate of increase in consumption was significantly below earlier rates. The progressive substitution of aluminium for other materials in a wide range of uses is noted as one reason for the relative lag in the consumption of the other non-ferrous metals.

The drag on growth throughout the post-war period, and particularly in the most recent phase, has been North America where *per capita* rates of consumption were highest at the outset: about 21 kg. of the five principal metals per year, compared with less than 8 in western Europe and less than 0.4 in the primary exporting countries. The second half of the nineteen fifties saw a substantial decline in North American consumption of each of the metals, with the exception of aluminium. In western Europe consumption continued to increase, though—again with the exception of aluminium—at a noticeably slower pace.

Consumption of the non-ferrous metals has increased more rapidly in the primary exporting countries than in the industrial countries: between 1946-1948 and 1958-1960 their intake of copper and zinc more than doubled, while aluminium intake rose fourfold. This expansion reflects less the change in final consumption of metal products than the spread of manufacturing industry, particularly in the category of fabricating plants. Notwithstanding this growth, the share of the primary exporting countries in world consumption of the non-ferrous metals remained small—only in the case of tin did it rise to more than 10 per cent—and its impact on the general trend continued to be marginal.

Fossil Fuel Trends

Fossil fuels have shown a consumption trend broadly similar to that of the non-ferrous metals in the post-war period, except that the acceleration in the middle phase, so noticeable in the case of the metals, was absent from the fuel trend. The substitution-based contrast between aluminium on the one hand and lead, zinc and tin on the other also has its counterpart in the evolution of fuel consumption: the extremely rapid rise in the use of petroleum was offset in large measure by the failure of coal consumption to expand much beyond its early post-war level.

In North America, coal consumption has followed a downward trend throughout the post-war period, dropping off rather more steeply in the most recent phase. This movement was neutralized to a large extent by slow expansion elsewhere, but in the latest phase, consumption turned downward in western Europe, too, leaving productive capacity appreciably above current rates of absorption for the first time since the nineteen thirties. In the primary exporting countries consumption has increased fairly rapidly throughout the post-war period. This is less a reflection of the expansion in industrial output than the result of continuing mechanization in most sectors of the economy with its consequential increase in the demand for fuel. In relation to world consumption, however, the total intake of the less developed countries has remained too small to exercise a clearly discernible influence on overall trends.

One reason for the absence of growth in solid fuel consumption in the industrial countries has been the steady improvement in the efficiency of coal utilization. This has been fairly general, both geographically and industrially, but quantitatively the most important coal economies have occurred in power generation and the iron and steel industry. More significant in its total impact, however, has been the substitution of other fuels for coal, most notably natural gas—chiefly in North America—and fuel oil and other petroleum products.

Even in the case of petroleum, however, the rate of growth in consumption tended to fall away in the second half of the nineteen fifties: from an annual average of about 8 per cent in the earlier period to one of about 6 per cent in the most recent phase.

Except in the case of coal, western European consumption of the major metals and fuels has continued to increase, and at rates which in phase three were not noticeably below those registered earlier. For most minerals, moreover—again with the exception of coal—changes in rates of consumption have tended to be translated fairly directly into changes in import demand. Compared with North America the lags have been relatively short and the upward trend relatively strong.

There is little evidence that import demand has been significantly affected, either in western Europe or North America, by any tendency towards increasing dependence on domestically produced scrap, the one possible exception being lead. Working in the opposite direction in respect of all the metals has been the notable expansion in exports of engineering products, particularly from western Europe. In so far as this has tended to reduce the potential supply of domestic scrap, import demand for the metal or its ore will have been increased.

Machinery and Equipment

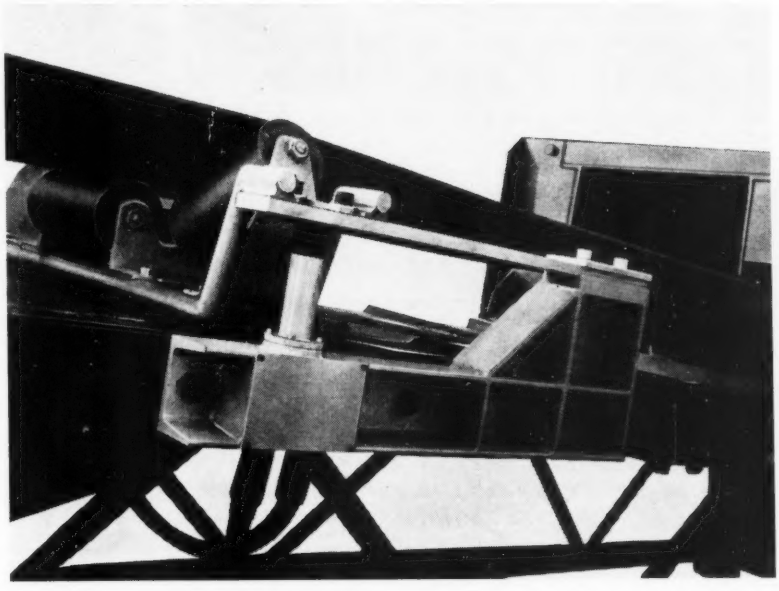
Continuous Electronic Belt Weigher

Craven Electronics Ltd., a member of the Sutcliffe Group, announce the introduction of the Craven Continuous Electronic Belt Weigher for automatically weighing and recording the weight of material carried on a conveyor belt. This is presented on a counter in units of weight to suit any requirements.

The unit is accurate to within 0.5 per cent even with a badly loaded and out of track belt. Inaccuracies due to friction cannot arise as there are no wearing parts in the weigh section. The unit is easily fitted to belt conveyors of any make or type and occupies virtually no extra space on the conveyor. Headroom is not restricted in any way and errors due to spillage are completely eliminated. All external circuits operate on low voltage and arrangements can readily be made for remote instrumentation. The equipment comprises three basic units.

The weighing section consists of two cantilever arms, positioned one on either side of the conveyor. These carry the weigh idler at one end, and are attached at the other end to the side frames. In turn, the side frames are bolted to the conveyor stringers. Any material on the conveyor belt deflects the arms proportional to weight (normally about 0.050 in. for a fully loaded belt). This deflection is transmitted to the armatures of the differential transformers which produce a small alternating voltage, the amplitude of which varies linearly with the deflection, i.e. with the weight of material on the conveyor belt.

The tachometer generator is driven from the underside of the top belt. Its function is to produce the energizing current for the weighing transducers. Thus the weight and belt speed are multiplied to produce a resultant flow rate signal. The transducers are adjusted during calibration to give zero signals with the conveyor belt running empty.



The weigh idler unit of the Craven continuous electronic belt weigher

The signal from the weighing section is amplified and supplied to an integrator motor. Linear and stable amplification is achieved by negative feed-back. The integrator motor has a disc incorporated which rotates at a speed directly proportional to the signal and is therefore proportional to the instantaneous deflection of the weigh idler section and belt speed. The integrator motor produces pulses whenever the disc rotates, e.g. when material is passing over the conveyor. This is accomplished by means of light passing through holes in the disc, and striking a photo-electric cell. A given weight is therefore made to produce a definite number of pulses in a given time.

A printing counter is actuated by the pulses from the integrator motor and records flow rate of material over the conveyor. Printing facilities are available on a tear off paper strip. The standard counter has six digits and will give a maximum reading of 999,999. The standard reading is to one decimal place. Provision for reading to two decimal places can be made if required. A low level cut out is incorporated to eliminate counting pulses should there be any variation in the weight of the empty belt. A switch is provided to isolate if necessary.

A new 130 c.f.m. self-propelled power pack compressor, manufactured by Air Pumps Ltd., is now available for the U.K. market and for export. Designated the Travelair, this mobile air power unit consists basically of Ford Thames 15 cwt. components with a Ford 592E four-cylinder diesel engine driving APL's 130 c.f.m. airflow-cooled two-stage compressor. One of its features is that the same diesel engine which drives the truck also runs the compressor

COAL CLEANING BATH

Mitchell Engineering Group, who hold exclusive licence for the only all-British dense medium bath, announce that during 1951 three new Mitchell coal preparation plants incorporating the Ridley Scholes bath were put into operation. The sites were Pye Hill (250 t.p.h.), Vane Tempest (330 t.p.h.) and Bates Pit (400 t.p.h.). Two other units are under construction at Newdigate (300 t.p.h.) and Blidworth (400 t.p.h.).

The Ridley Scholes bath, invented, developed and built by British engineers, treats sizes from 10 in. to ¼ in. and separates efficiently at any specific gravity from 1.3 to 1.8.

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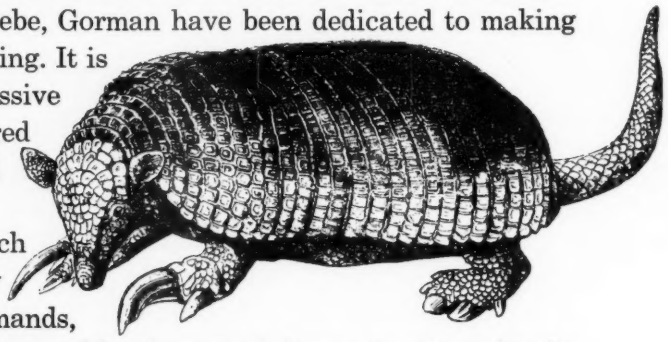

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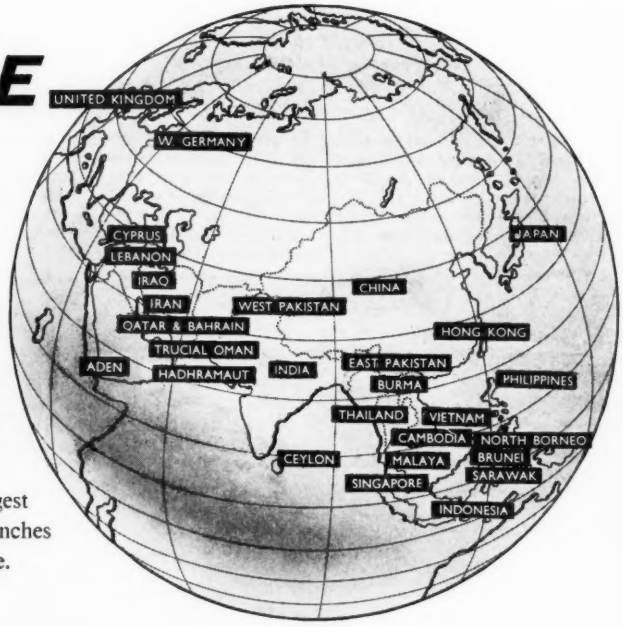

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MINING MISCELLANY

Elektrokemisk A/S is studying plans for a new aluminium plant in southern Norway, possibly at Lista. A project to obtain power for the plant from the Sira and Kvina rivers in the area is under consideration.

★

According to the East German news agency *ADN*, considerable reserves of minerals have been discovered in East Germany during the last ten years by the area's State Geological Commission. Proved reserves in East Germany are stated to include 80,000 tonnes of copper ore, approximately 20,000,000 tonnes of iron ore, 100,000,000 tonnes of hard coal, 4,000,000,000 tonnes of brown coal, 2,000,000,000 tonnes of potassium salts and 2,500,000,000 cu. metres of natural gas.

★

The ten pesetas per ton levy on Spanish iron ore exports has been abolished.

★

Independent shareholders of Patino Mines and Enterprises have approved a settlement with the Bolivian government, which nationalized the mines in 1952. Their votes are exclusive of the 620,454 shares owned by the Patino family, whose stock represents about 45 per cent of the outstanding shares. The Bolivian government is to pay $6,000,000 to the entire Patino Group of tin mining companies.

Work on Indonesia's first tin smelter is to start soon at Bangka, on the island of Java. A contract for its construction has been signed by the director of the Indonesian State Tin Corporation and a representative of the West German firm of Klockner-Industrie-Anlagen. The new plant, which is expected to take over two years to build, will provide Indonesia with her domestic tin requirements.

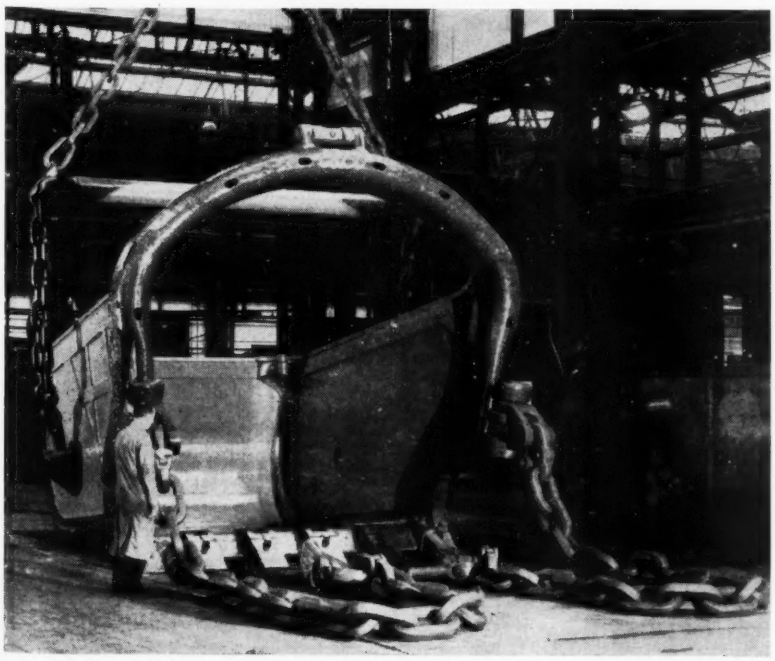
★

The Trustees of the Education Trust of the Royal Institution of Chartered Surveyors invite applications from individuals or groups for grants for research in any branch of surveying. Applicants who need not be chartered surveyors, should communicate with Hon. Secretary, RICS Education Trust by October 31, 1961.

★

The High Authority of the European Coal and Steel Community in Luxembourg has announced the grant of a loan amounting to U.S.$527,000 to the Providence ferrous metals concern of Belgium. The loan will be used for research into the automation of iron ore processing. The Authority has also granted two 20-year loans, each with 4⅞ per cent interest and totalling 205,000,000 Belgian francs, for the building up of new industry and rehabilitation of redundant mineworkers in the Liege coalfields.

Hadfields Ltd. have recently completed a 40 cu. yd. Esco dragline bucket, delivery of which has been taken by the National Coal Board. This bucket, claimed as the largest of its kind, weighs 33 tons 13 cwts. fully rigged and when loaded approximately 90 tons. The overall dimensions are, length 19 ft. 6 in., width 13 ft. 9 in. and the height 14 ft. 6in. It is operating on a Ransomes and Rapier W.1800 walking dragline



Cerro de Pasco Corporation has awarded a contract to Morrison-Knudsen Co. Inc., for the driving of the Graton dual drainage tunnel at the Casapalca Mine in the Peruvian Andes (see *Mining Journal*, March 24, p. 339).

★

The Finnish uranium ore mine at Paukkajanvaara, near Eno, in northern Karelia, is to cease production until further notice, as the quality of ore mined has proved very variable. The operating company hopes to continue production from a larger deposit yet to be investigated, mining of which would be possible by opencast methods. The Paukkajanvaara ore, which was exported in concentrated form to Sweden, was first mined by opencast and later from 200 m. depth. It was opened last summer by Atomienergia Oy.

★

The U.S. Bureau of Mines has awarded a contract for carrying out exploratory drilling, to Boyles Bros. Drilling Co., of Salt Lake City, Utah. The programme is to determine the extent of a coalbed fire on Federal land northwest of Grand Junction, Mesa County, Colo. Known as the "Smokey Mountain" fire, the blaze was first reported in 1958, and has burned more than 1,000 feet along an outcrop, and covers about 6 acres. Coalbed thickness, quantity of coal involved and how best to control the fire cannot be determined until after the drilling.

★

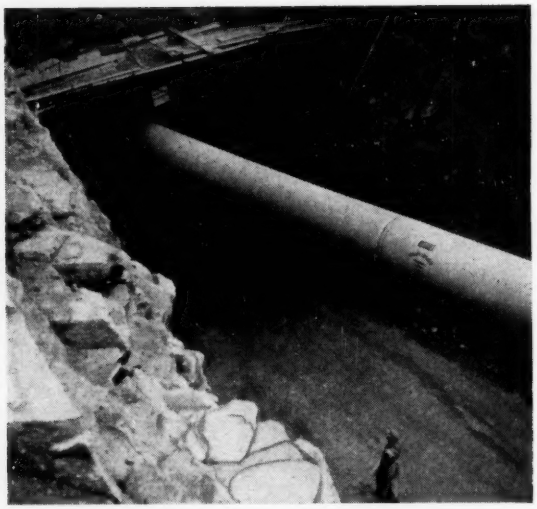
The first large scale attempt to mine diamonds from the sea bed is about to be made off the south-west coast of Africa. The Marine Diamond Corp. has obtained a concession covering 176 miles of the coastline north of the Orange River. It has applied for other adjoining concessions which would give it some 800 miles. The Collins group of companies proposes to recover the diamonds by using an air syphon and jet arrangement which has already been tested by removing shell, sand, gravel and boulders from pipeline trenches under water. The gravel on the sea bed is forced up and transferred to diamond pans which have a combined capacity of more than 100 tons an hour. Operations will be carried out in the shallow water off the coast. The craft needed are already available. Technical tests will be carried out with the help of the General Mining and Finance Corporation.

★

A three-member British coal team will be arriving in India on August 25 to advise the National Coal Development Corporation on the development of deep-shaft mines. The team consists of Mr. H. E. Collins, Member for Production of the British National Coal Board, J. W. Eliott, and Mr. G. Armstrong. Mr. Eliott will stay in India to prepare the project reports after the two other members leave.

★

Nitto Metal Mining Co. of Japan is testing iron ores from the Lipez district of Bolivia. Nitto has already purchased one copper mine in Bolivia, with a monthly production of 10,000 tonnes, which is to start operations by the end of 1962, and is negotiating for the purchase of another. These are in addition to the three copper mines whose products Nitto already imports into Japan.



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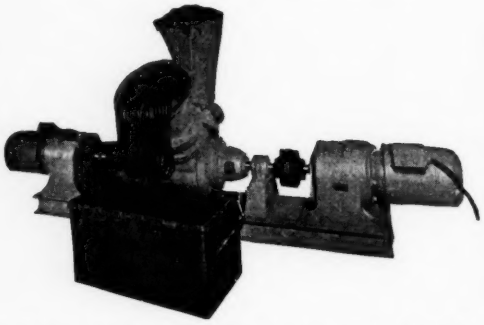

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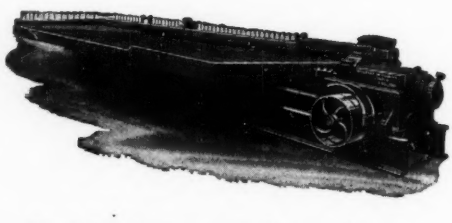

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Metals and Minerals

India's Declining Manganese Exports

The World Trade Department of the Indian Chamber of Commerce, Calcutta, has urged the Indian government to re-orient its policy on exports of manganese ore in such a way as to restrict the activities of the State Trading Corporation and permit the private sector to maintain, if not augment, the export of this commodity. This plea is contained in a study on the "Overseas Markets for Manganese Ore", recently published by the Chamber. India's exports of manganese ore have suffered a setback, following the entry of the S.T.C. into the export trade from July 1956. Earnings from the export of ore fell from as much as Rs. 320,000,000 in 1957 to about some Rs. 130,000,000 in 1959 and Rs. 140,000,000 in 1960.

Analysing in detail the trend of India's exports to important markets, the study says that exports to the U.S. in 1957 amounted to 792,000 tons again the total export of 1,715,000 tons. In subsequent years the decline was steep, particularly in 1958 and 1959 when the U.S. offtake plummeted to 379,000 tons and 380,000 tons respectively. In 1960, however, exports to the U.S. improved to 441,000 tons, but the improvement was negligible both in relation to past performance and to that of other competitors.

Japan, the second largest market for Indian ore, accounted in 1959 and 1960 for 15 to 16 per cent of the total shipments, the competitors in this market being Indonesia, the Philippines and Australia, and, to some extent, South Africa and Mozambique. Imports from these countries into Japan are increasing at a higher rate than those from India. In France also there is a growing competition from North Africa and Eastern Europe. Export to W. Germany steadily fell from 47,000 tons in 1958 to 31,000 tons in 1959 and 28,000 tons in 1960, the U.S.S.R. becoming the main supplier.

In the U.K. too, India is losing ground In 1955, of 405,000 tons imported by the U.K., India's share was the largest, being 124,000 tons as compared with 122,000 tons from Ghana and 118,000 tons from Russia. But in 1960, the largest supplier was the Union of South Africa, accounting for 141,300 tons, while the Soviet Union came next with 136,600 tons. India took the third place with her exports at 128,000 tons.

In fairness to the S.T.C., it should be said that there were several factors, besides its own mismanagement, that lead to the debacle in the manganese ore export trade. U.S. purchases, for instance, had been steadily declining since 1953, even before the S.T.C. came into being, due, in some measure, to the fall in steel production in that country and the decline in the offtake for stockpiling. In addition, the U.S. has turned to its neighbour, Brazil, for regular supply. Brazil's share in the U.S. market rose from only 5 per cent in 1953 to 25 per cent in 1959, thereby making it the largest single source of U.S. imports of manganese ore. This switch was necessitated by the difficulties experienced by the U.S. importers and consumers in getting regular and adequate supplies. The uncertainty created in India's supply of ore by the fluctuating export duties and quantitative restrictions on exports acted as a further disincentive to the U.S. buyers. Due, more or less, to these factors, the U.K. also found a better supplier in Russia, and Japan in Australia and Indonesia.

The increasing competition in world markets has affected the prospects for India's exports of manganese ore to some extent. But, it is alleged that if the export trade had not been bogged down by government intervention, the more enterprising sections of export business would have met the challenge.

The view is expressed that, apart from eliminating the S.T.C.'s control over the trade, there is need for bringing down the price of Indian manganese ore, for it does not compare well with that of its major competitors. At present, the price of Brazilian and South African ore (46-48 per cent) in U.S. ports is quoted at $34.50 per ton on c.i.f. basis, as against $38 for Indian ore. The study suggests that the price of the Indian product can be brought down if the heavy incidence of railway freight, port charges, etc. are reduced by at least 50 per cent. Another important suggestion is that, in order to improve the productivity of their mines, mine-owners should be permitted to import machinery and spare parts against their earnings of foreign exchange. It may be noted here that recently the government announced a scheme of this sort allowing 5 per cent (10 per cent in special cases) of the export earnings for importing mining machinery. This has fallen far short of the expectations of the trade. Five per cent is regarded as too negligible a share to be of any significance in importing costly mining equipment. The mine owners feel that they would be fully justified in asking for at least 25 per cent of export earnings to be set apart for importing the machinery needed.

(Continued overleaf)

MINERALS IN EGYPT

The Ministry of Industry of the United Arab Republic has issued a report on raw materials in the Egyptian region of the Republic. This states *inter alia* that samples are currently being studied from newly-discovered iron ore deposits in the area; these are situated in Wadi Kerim, where 38,000,000 tonnes are estimated to be deposited, in Gebel Ghurabi with some 200,000,000 tonnes and El Hiza (in the El Bahria oasis) with an estimated 100,000,000 tonnes of ore.

Production at the Aswan iron ore mines (*Mining Journal Annual Review, 1961*) is to be raised to 550,000 annual tonnes by mining mechanization there. Lead and zinc reserves are believed to be in existence in the Red Sea coastal district and in the Gebel El Sambuki region, lead reserves being put at 1,000,000 tonnes. A zinc refinery is to be built at Suez.

In the phosphates field, the exploitation of recently-discovered deposits at El Hamrawein, Om El Toweig and in the region between is to be developed in the period ending 1964, production of the El Hammama and El Sibaija mines to be increased over the coming years to 400,000 annual tonnes. Phosphate reserves in the Dachla and Charga oases, estimated at 100,000,000 tonnes, are not to be exploited in the foreseeable future.

Mica has been determined in Egypt, it is further stated.

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BRITISH ALUMINIUM'S EXPANSION PROJECT

Lord Plowden, chairman of British Aluminium, has announced that the group's subsidiary, Canadian British Aluminium, is to expand its Baie Comeau smelter by another stage to produce an additional 45,000 s.tons of aluminium per annum. Construction work on this project is to be started some time in 1963 in order to bring the additional facilities into operation by July, 1965. Arrangements have been made to obtain the required power from Hydro-Quebec. The cost of this expansion is estimated to be about $36,000,000 (£12,500,000).

As originally planned, the Baie Comeau project was to be developed in four stages, each with a designed annual capacity of 40,000 l.tons of ingot. The first stage came into operation in December, 1957, and the second stage early in 1959. Stages 3 and 4 were scheduled for 1961-65. The present capacity of the plant is 90,000 s.tons annually.

Last year Canadian British Aluminium had a net loss of $1,438,273, bringing its total deficit up to $3,973,587, but it is expected that the company will show a profit for the financial year just ended.

ALUMINIUM IN EUROPE

Speaking at the Fourth International Light Metal Conference in Leoben, M. R. de Vitry, president of Péchiney, stated that Europe's aluminium consumption had risen from 388,000 tonnes in 1950 to 1,330,000 tonnes in 1960. Expansion plans currently under way would raise Western Europe's capacity from the present figure of 920,000 t.p.a. to 1,320,000 tonnes.

*

Reynolds International Inc. and Société Générale de Belgique have formed a company—Aluminium Europe—to build a plant in Belgium for the fabrication of aluminium products.

*

In the first half of 1961 French production of primary aluminium amounted to 131,381 tonnes. This was as much as 24 per cent more than in the corresponding period of last year.

*

The West German aluminium producer, Vereinigte Aluminiumwerke AG, of Bonn, has announced an output for 1960 of 122,000 tonnes of aluminium as compared with 109,000 tonnes in 1959. With the future opening of a new production unit at Norf, near Neuss am Rhein, the VAW capacity will be brought up to 160,000 t.p.a. The company already accounts for 72 per cent of West Germany's production of refined aluminium.

*

Production of aluminium semis in West Germany is now reported to be running above the amount of orders being received. Orders have receded considerably since the boom period in the second half of last year, but there are still enough in hand to keep production at a high level. Consumers' stocks have been falling, however, and the industry is confident that the situation will improve. Imports of semis into West Germany are still

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rising. After trebling last year to a total of 8,000 tonnes, they are now running at a monthly average of 900 tonnes and for the current year they are expected to be higher by about 25 per cent than in 1960.

★

A report from East Berlin states that the Lauta aluminium plant in East Germany, the first section of which is to be opened in October next year (*vide Mining Journal*, July 14, 1961), will consume 1,940 kg. of calcined alumina and 17,500 kWh. of electricity per tonne.

OTHER ALUMINIUM PROJECTS

Mr. K. A. Gbedemah, Minister of Health and former Minister of Finance in the Ghana government, announced on his return to Accra from the U.S. that the final signing of documents granting Ghana a £35,000,000 loan for the Volta River project would take place within the next few weeks. This sum would be lent by the World Bank and the U.S. and British governments.

The Minister also announced that the U.S. government had agreed to lend $98,000,000 (£35,000,000) to the Valco aluminium consortium, which is to build a smelter based on Volta power. This may be followed, if required, by a further $42,000,000 (£15,000,000), the two amounts equalling approximately half the cost of the smelter.

★

A U.S. corporation, American and Foreign Power Co., plans to invest nearly $4,000,000 in a $16,500,000 aluminium refining plant to be built in Mexico.

GOOD PROGRESS AT WEIPA

Comalco is reported to be making good progress in the development of the Weipa bauxite deposits on Cape York, in preparation for its integrated aluminium industry in Australia and New Zealand. Exploratory work is nearly ended and has shown deposits of more than 600,000,000 tons of commercially payable bauxite. This will be mined by opencast methods at the rate of 1,000,000 t.p.a. A new plant will produce 300,000 tons of alumina a year for shipment to Invercargill in New Zealand for smelting. The mine has already produced 40,000 tons, of which 30,000 tons has been sent to Japan and 10,000 tons to Bell Bay, Tasmania, for testing.

So far Comalco has spent £2,000,000 on the Weipa project and eventual expenditure could reach £45,000,000. The tempo of operations is reported to have been speeded up since Kaiser Aluminium became a partner of Consolidated Zinc in Comalco and steps were taken to organize mining, smelting and fabricating sections. At present the main activity is the £1,250,000 dredging of port channels by the Westminster Dredging Co.

ANTIMONY ORE

The open market price for antimony ore is currently indicated at 30s.-35s. per l.ton unit c.i.f. for basis 60 per cent lumpy material low in impurities. A month or two ago it ranged from 32s. to 35s. The wider range probably reflects quite considerably the variation in quality, especially in Bolivian ores. Production in Bolivia is said to be running at a lower level. Not much Bolivian ore is on offer and it is understood that shipments from South Africa are also at a reduced rate. Demand is less pressing because of seasonal influences, but there would probably be buyers for any suitable grade of ore. In the U.K., whose requirements are largely covered under long-term contract with South Africa, the price remains unchanged at 26s.-28s. c.i.f.

ELECTROLYTIC MANGANESE

The Foote Mineral Co. has decided to develop intensively markets for electrolytic manganese in Europe. An Italian company, Elettromanganese SPA, has been formed for the purpose of producing electrolytic manganese within the Common Market. While operating facilities are being constructed, the market will be supplied from Foote's domestic plants.

UNCERTAIN QUICKSILVER MARKET

Generally speaking, demand for quicksilver in the London market remains quiet and the moderate amount of metal said to be available on the spot seems sufficient to keep the tone subdued. A number of suppliers now quote £63 per flask instead of £64 previously, but even the former price looks rather precariously poised in view of cheaper offers from other sources at £62 and possibly slightly less. Some of the quicksilver emanating from Russia is believed to be of Chinese origin.

Market sentiment is not being helped by the continued weakening in the New York price which fell recently by $4, the biggest movement for some time. Excluding import duty, the U.S. price is now equivalent to around £60 10s.

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Copper · Tin · Lead · Zinc

(From Our London Metal Exchange Correspondent)

Markets are still under the influence of the holiday season and have been featureless.

COPPER SLIGHTLY FIRMER

The copper price has firmed slightly owing to the continued uncertainty about the labour situation in Chile coupled with reports of unrest in Rhodesia, although it has been stated that the latter is unlikely to have any effect on copper production. The negotiations in Chile still go on, and at the time of writing a deadline has been set for midnight on August 10. Should a strike then break out at El Salvador there will be a sympathetic outbreak at Chuquicamata. The danger of any trouble in the U.S. seems to have passed, and should there be a settlement elsewhere the market may fall back for a short period. In the long run, however, the majority of dealers consider that the autumn will see higher levels.

In the U.K. copper stocks again rose by 526 tons to a total of 21,651 tons, and there are indications that the contango may widen. The latest figures from the U.S. giving domestic consumption of copper by brass and wire mills and foundries show a total of 123,114 s.tons as compared with 145,804 s.tons in May. New business also fell, and stocks rose to 455,784 s.tons at the end of the month as compared with 439,198 s.tons at the end of May. These figures are somewhat disappointing in view of the generally optimistic forecasts coming from the U.S., but it may be that buying in previous months had been excessive and that the picture will not straighten out until the summer recess is over.

LOWER TIN SHIPMENTS FROM EASTERN PORTS

The tin market maintains its firm undertone with small advances being recorded in Singapore, and it is expected that this tendency will continue until the next meeting of the International Tin Council scheduled for August 22. Stocks in London fell by 28 tons at the beginning of the week to a total of 6,136 tons, and the contango remains unchanged.

From news reports it appears that there has been some change in the attitude of the U.S. administration towards the International Tin Council, and some people go so far as to say that the U.S. may join. It is interesting to note in this connection that the General Services Administration did not accept bids for the total 500 tons of tin offered recently, only 350 tons being sold at a price slightly below the cost of Straits tin at the time. It looks as though the policy is not to sell tin in order to get rid of it.

Shipments of tin in July from Penang totalled 5,924 tons against 6,797 tons in June, and shipments from Singapore totalled 495 tons against 646 tons in June. These figures seem to indicate that reports about the inability of the Malayan producers to increase production are correct.

Figures issued by the I.T.C. give world production of tin in concentrates in April as 12,900 tons against 12,800 tons in March, whilst smelter production in April totalled 14,600 tons against 13,500 tons in the previous month. World consumption of primary tin in April was put at 15,200 tons as compared with 15,800 tons in March.

On Thursday the eastern price was equivalent to £942⅜ per ton c.i.f. Europe.

LEAD STOCKS FALL—ZINC LITTLE CHANGED

The main event in the lead and zinc markets has been a reduction of 950 tons of stock, the former metal reducing the total to 11,204 tons. This was unexpected and caused a momentary narrowing of the contango. Zinc stocks remain almost unchanged with a reduction of 55 tons to a total of 6,528 tons, and in this market the contango shows signs of widening. In the U.S. domestic lead produced in the first half of 1961 totalled 135,925 s.tons, an increase of over 1 per cent over the figure for the corresponding period of 1960.

In O.E.E.C. countries the production of lead in June was issued at 71,369 tonnes compared with only 64,029 tonnes in May, and stocks at the end of June rose to 57,368 tons as compared with 55,513 tons at the end of May. Production of zinc in the U.S.A. for July was 69,755 s.tons as compared with 72,816 s.tons in June, deliveries for July totalled 70,971 as against 78,050 for the previous month, and stocks for July totalled 206,604 as compared with 207,820 s.tons for June. Production of refined zinc in O.E.E.C. countries was issued at 80,312 tonnes for June as compared with 81,477 tonnes for May. Stocks however, showed a substantial increase at the end of June at 59,757 tonnes as compared with 52,809 tonnes a month earlier.

Continued efforts are being made in the U.S. to get some Bill passed through Congress to assist the smaller domestic lead and zinc miner. At the time of writing there are two Bills being processed, both of which envisage subsidies based on a higher combined price for lead and zinc than exists at the moment, and one providing for the abolition of quotas but a guarantee of 50 per cent of the U.S. market for U.S. producers and increased tariff on imports of ores, residues and productions. It is the point about the abolition of quotas which is of most interest to non-Americans, as should this happen there would be an immediate flow of metal to adjust the sterling and dollar prices which at the moment are out of parity.

OFFICIAL TURNOVERS

Official turnovers (in l.tons) for the week ending August 4, with the previous week's figures in parenthese are :—

Copper	18,150	(15,375)
Tin	1,615	(1,525)
Lead	8,200	(9,175)
Zinc	6,550	(3,775)

Closing prices are as follows :

	August 3		August 10	
	Buyers	*Sellers*	*Buyers*	*Sellers*
COPPER				
Cash	£229½	£229¾	£229¾	£230
Three months	£232¼	£232¾	£233¼	£234
Settlement	£229¾		£230	
LEAD				
Current ½ month	£64⅞	£65	£64⅞	£64⅞
Three months	£66	£66¼	£66	£66¼
TIN				
Cash	£920½	£921	£924½	£925
Three months	£932	£933	£936	£936½
Settlement	£921		£925	
ZINC				
Current ½ month	£78	£78¼	£76¾	£76⅞
Three months	£78⅛	£78⅜	£77⅛	£77⅜

LONDON METAL AND ORE PRICES, AUGUST 10, 1961

METAL PRICES

Aluminium, 99.5%, £186 per ton
Antimony—
English (99%) delivered, 10 cwt. and over £230 per ton
Arsenic, £400 per ton
Bismuth (min. 1 ton lots) 16s. 1b. nom.
Cadmium 11s. 0d. lb.
Cerium (99%) net, £15 0s. lb. delivered U.K.
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.
Cobalt, 12s. lb.
Germanium, 99.99%, Ge. kilo lots 2s. 5d. per gram
Gold, 251s. 8d.
Iridium, £20/£23 oz. nom.
Lanthanum (98%/99%) 15s. per gram
Magnesium, 2s. 2½d./2s. 3d. lb.
Manganese Metal (96%/98%) £275/£285
Nickel, 99.5% (home trade) £660 per ton
Osmium, £17/£22 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £27 7s. 6d./£27 17s. 6d.
Quicksilver, £63 ex-warehouse
Rhodium, £43/£45 oz.
Ruthenium, £14/£16 oz. nom.
Selenium, 46s. 6d. per lb.
Silver, 79½d. f. oz. spot and 80½d. f'd.
Tellurium, 37s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis	30s. 0d./35s. 0d. per unit c.i.f.
Beryl (min. 10 per cent BeO)	270s./275s. per l. ton unit BeO
Bismuth	30% 5s. 0d. lb. c.i.f.
	20% 3s. 3d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semifriable 48%) (Ratio 3 : 1)	£15 5s. 0d. per ton c.i.f.
„ Hard Lumpy 45% (Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
„ Refractory 40%	£11 0s. 0d. per ton c.i.f.
„ Smalls 44% (Ratio 3 : 1)	£13 5s. 0d. per ton c.i.f.
Baluchistan 48% (Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10:1) $Nb_2O_5 : Ta_2O_5$	160s./165s. 0d. per l. ton c.i.f.
Lithium Ore—	
Petalite min. 3½% Li_2O	50s. 0d./55s. 0d. per unit f.o.b. Beira
Lepidolite min. 3½% Li_2O	76s. 0d./80s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O	75s. 0d./85s. 0d. per ton f.o.b. Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£23 0s. d/d
Manganese Ore Indian—	
Europe (46%-48%) basis 60s. 0d. freight	73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)	69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)	nom.
Molybdenite (85%) basis	10s. 0d. per lb. (f.o.b.)
Titanium Ore—	
Rutile Australian 95/97% TiO_2 (prompt delivery)	£23 5s. per ton c.i.f.
Ilmenite Malayan 50/52% TiO_2	£11 10s. per ton c.i.f.
Ilmenite Travancore 58/60% TiO_2	£15/£15 10s. per ton c.i.f.
Wolfram and Scheelite (65%)	128s. 0d./132s. 0d. per unit c.i.f.
Vanadium—	
Fused oxide 95% V_2O_5	7s. 6d./8s. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2	£16 ton c.i.f.

Mining Finance

Nchanga—Twenty Years Young

In the early days of the 1930's the Nchanga mine was owned by the Rhokana Corporation and this company spent large sums of money in exploratory and development work. However the mine suffered badly due to the problems arising from the great slump. In fact, at one stage it was closed down.

In March 1937 the Nchanga Consolidated was formed to acquire from Rhokana the mining and necessary surface rights and in 1940 full operations were commenced. In the year ending March 31, 1941 the mine produced 11,812 tons of copper and made a profit, before tax, of £22,000. Twenty years later, in the year under review, Nchanga produced 184,000 tons of copper and made a profit, also before tax, of £20,200,000.

As the chairman, Mr. H. F. Oppenheimer, has said in his review, published on page 151, this is indeed a remarkable expansion. Over £47,000,000 has been invested in the mine of which £38,000,000 has been retained from profits. Since 1951, when the company moved its administration to Northern Rhodesia, the liability to tax has amounted to almost £58,000,000 and, over and above the funds that have been provided for educational and social projects in the Federation, the company has agreed to subscribe £7,000,000 for the Kariba hydro-electric schemes and other essential developments. This is a truly remarkable record for such a "young" mine.

When thinking of a mine's age one tends to look at the life that is ahead of it rather than at what is behind and on this basis Nchanga, despite its twenty years, must be a young mine. At the current rate of production the ore reserves, at 184,166,000 s.tons, are equal to over 35 years' production and there is every likelihood of further substantial additions being made to the reserves.

Reserves alone do not make a great mine, flexibility and sound cost structure must play a large part, but here again Nchanga is in a very sound position, with production coming from three separate production units, two open-cast and one underground. Unit costs, as such, are not given in the annual report but from the operating cost figures in the annual accounts it is possible to estimate that, including realization charges, the production cost of primary copper is a little over £120 per l.ton. In this cost there are certain items, particularly wages and royalty, which are a function of the L.M.E. copper price and thus it tends to rise and fall with the Metal Exchange price, but despite these fluctuations this order of cost obviously puts the mine in a very strong position. This is an overall cost figure for both the underground and open-cast operations and it must be assumed that in times of stress the production rate from these three units could be adjusted in order to reduce costs still further.

At present, Nchanga is the second largest single copper producer in the world and with such large ore reserves one could reasonably ask, what of Nchanga's future? Until such time as the world demand picture for copper changes in favour of the producers it is unlikely that any plans for a major expansion will be announced, but in the meanwhile the chairman has told the shareholders that the erection of a roasting plant will increase production by some 300 tons per month by improved extraction, without increasing the mining rate. The plant will also recover more economically about 600 s.tons of copper per month from concentrates at present smelted by the Rhokana Corporation.

The Rhokana smelter has been working at maximum capacity and being now relieved of the production of 600 tons per month from Nchanga it should be able to smelt additional sulphide ore from the Mindola section at Rhokana itself. It will be recalled that the production at the Mindola section has been recently expanded with the commissioning of the No. 2 shaft.

In the short term and particularly during the current year it is likely that the profits will be lower due mainly to slightly lower sales and to a lower copper price. During the first four months of Nchanga's year the price has been about £3 per ton lower than last year. However, the demands of the capital account should not be as great and it is unlikely that the dividend will be reduced by more than 6d. per share, if at all. At their present price of 49/- the shares stand to yield 14.3 per cent or on a 6s. 6d. dividend 13.3 per cent not counting any D.T.R. relief.

THE RHODESIAN POLITICAL DISCOUNT

For shares such as Nchanga and Rhokana to stand on a 14 per cent yield basis, higher than most leading South African gold mines, the market must be taking a very poor view of Sir Roy Welensky's chances of maintaining stable conditions on the Copperbelt. Politics aside, these Rhodesian mines should not stand at more than a 7 per cent yield and thus the "political discount" can be estimated at a further 7 per cent. Is this a reasonable discount? All things considered probably not; in fact, the market has obviously been in two minds itself for the Rhodesian section has recently gained a little ground despite the fact that generally most sections have been falling.

The main question is, which particular political event is to be the turning point? Whilst there was no direct connection, it would have been reasonable if the market had regarded the Southern Rhodesian referendum as a major pointer, but the scattered outbreaks of violence in the Northern Province, together with Kaunda's "liquid position" seem to have discouraged any substantial recovery. The next political land mark is the Northern Rhodesian election under the new constitution and if these elections pass off quietly with the major African Nationalist parties taking part then this must surely be the turning point. In the meanwhile, if the disturbances in the Northern Province are curbed it would not be unreasonable to see the political discount gradually reduced to say 11 per cent.

(Continued overleaf)

London Market Highlights

The South African Gold share market made an unimpressive start to the week after its previous improvement. This was hardly surprising in view of the general post-holiday gloom in the house. But after dealers had marked Kaffir prices down by a few pence a few cautious buyers reappeared and the market had regained its aplomb by the close of business on Tuesday. That evening dealers were surprised to find that a few Transatlantic buying orders were keeping the phone lines busy. On Wednesday the market was enlivened by a U.S. demand for Free State Geduld which lifted the shares by 6s. 3d. to 83s. 9d. The demand by-passed Western Holdings which, out of the picture for once, lingered at 122s. 6d. But it was thought to have been the reason for a sudden jump in the Western Deep issues, the "A" shares rising 2s. 4½d. to 36s. 10½d., and there was little doubt that U.S. buyers were responsible for a rise of 5s. to 131s. 3d. in De Beers.

Otherwise, Wednesday brought a scattering of small gains most of which were recoupments of the Tuesday price-lowering because there was little genuine business. "Ofsits", for instance, regained 1s. 3d. to 62s. 6d. with little business passing and West Driefontein were rather nominally marked up 1s. 3d. to 80s. The break-up stocks hardened a few pence following the official confirmation that their capital repayments are not affected by South Africa's exchange control regulations. Robinson Deep thus improved 3d. to 4s. 3d. The one really dull spot in Kaffirs was Free State Saaiplaas which fell 1s. to a new low of 3s. 6d. on persistent and unexplained offerings from the Cape, the move may have been more a result of "arbitrage" operations than of any fundamental change in the share's merits.

Rhodesian Coppers ran into a little nervous selling following week-end reports of minor sabotage on the Copperbelt. The actual selling was light but in a thin market share prices had to give ground. Losses of around 1s. 3d. were soon registered in Nchanga 47s., Rhokana 47s. 3d. and Chartered 64s. Later, these prices tended to harden when it was realised that the very high yields offered on such good-class stocks were already discounting a certain amount of political unrest.

The Malayan tin section produced a scattering of small price gains from time to time as Eastern buyers reappeared. London was still disinclined to do little more than occasionally take a profit. It may well be that London is justified in taking this line. There is a feeling that when the monsoon ends in a week or two we may see a resurgence of political unrest in the Far East. Whatever the case, mainwhile, a potential buyer has no need to do more than be patient at this stage.

The Australian issues, which have been good markets, recently came in for some profit-taking. Consolidated Zinc, for instance, which had jumped 3s. 9d. to 73s. 9d. on the previous Friday to meet a trustee demand, relapsed to 72s. but still showed a rise of 5s. or so on the past fortnight. Western Mining, which strengthened to a new high of 21s. 10½d. on the iron ore project news eased to 21s.; at one time this year the shares were only 9s. 9d. Otherwise, Burma Mines came to life with a jump of 9d. to 1s. 9d., reflecting speculative buying on hopes of a rise in the silver price.

Rand and Orange Free State Returns for July

GOLD OUTPUT AND PROFIT

Company	July 1961 Tons (000)	July 1961 Yield (oz.)	July 1961 Profit† (R000)	Year ends	Current Financial Year Total to date Tons (000)	Current Financial Year Total to date Yield (oz.)	Current Financial Year Total to date Profit† (R000)	Last Financial Year Total to date Tons (000)	Last Financial Year Total to date Yield (oz.)	Last Financial Year Total to date Profit† (R000)
Gold Fields										
Doornfontein	125	53,500	630·8	J	125	53,500	630·8	105	42,620	433·4
Libanon	119	30,255	176·6	J	119	30,255	176·6	117	27,910	134·3
Rietfontein	12	3,170	3·5	D	84	22,599	20·7	110	29,098	86·8
Robinson	45	9,929	4·4	D	502	67,934	19·9	314	68,867	L8·0
Simmer & Jack...	71	12,384	3·1	D	489	88,379	3·3	533	94,603	L93·3
Sub Nigel	66	15,022	26·7	J	66	15,022	26·7	66	15,079	30·3
Venterspost	127	38,227	202·3	J	127	38,227	202·3	123	34,133	150·1
Vlakfontein	53	19,597	187·8	D	366	135,141	1301·8	361	129,373	1221·8
Vogels	80	17,244	26·0	D	965	120,999	194·6	600	129,003	286·8
West Drie	180	140,402	2435·6	J	180	140,402	2435·6	130	120,836	2145·6
Anglo American										
Brakpan	146	18,605	59·9	D	1,001	126,504	320·9	998	120,803	172·4
Daggas	228	46,008	462·6	D	1,582	319,969	3183·1	1,625	328,221	3191·6
East Daggas	108	18,421	84·4	D	752	128,489	591·0	736	124,840	567·6
F.S. Geduld	100	86,565	1410·3	S	964	839,695	13663·9	940	808,211	12957·4
President Brand ..	130	100,866	1728·3	S	1,220	961,364	16620·3	1,161	946,277	16617·1
President Steyn ..	110	41,421	332·0	S	1,078	403,527	3379·1	1,014	392,951	3538·4
S.A. Lands	111	22,255	102·1	D	754	152,366	711·1	675	140,282	613·6
Springs	94	13,883	50·0	D	654	91,863	255·9	719	99,964	202·6
Vaal Reefs	114	53,295	566·0	D	740	346,415	3748·9	683	307,577	3200·0
Welkom	104	32,607	134·3	S	992	314,657	1342·8	983	310,056	1491·8
Western Holdings.	175	121,222	2086·0	S	1,651	1,132,770	19349·6	1,464	969,284	15989·4
West. Reefs Ex...	155	45,184	315·5	D	1,048	304,863	2076·9	980	276,254	1844·6
Central Mining										
Blyvoor	138	86,324	1316·0	J	138	86,324	1316·0	133	86,519	1298·7
City Deep	121	23,636	7·0	D	802	165,158	50·9	791	162,989	76·7
Cons. M.R.	39	8,974	3·2	J	39	8,974	3·2	62	12,028	10·9
Crown	178	31,131	3·1	D	1,264	220,034	17·7	1,399	236,459	82·1
D. Roodepoort ..	200	37,024	104·7	D	1,345	249,544	699·4	1,346	246,353	691·0
East Rand Prop. .	230	55,449	200·1	D	1,648	372,236	984·8	1,545	382,509	1191·6
Harmony	202	81,302	796·1	J	202	81,302	796·1	167	66,830	610·2
Modder East	61	6,360	L1·0	J	61	6,360	L1·0	125	12,834	2·3
Rose Deep.....	23	4,072	1·2	D	157	28,330	L3·7	171	29,949	17·6
J.C.I.*										
Freddies Cons. ..	65	13,512	L30·0	D	444	92,077	L326·3	417	93,170	L572·3
Govt. G.M.A.....	34	6,268	L30·4	D	282	57,059	L112·6	369	75,588	7·1
Randfontein	18	3,268	1·4	D	121	21,030	10·1	168	32,966	43·4
Union Corporation										
East Geduld	124	34,844	417·8	D	882	250,680	3030·5	927	272,314	3504·7
Geduld Prop.	80	12,805	40·0	D	550	88,383	295·4	514	91,454	332·5
Grootvlei	220	45,499	454·7	D	1,515	313,585	3072·4	1,505	313,380	3189·2
Marievale	99	23,760	240·0	D	686	165,449	1686·1	690	168,841	1757·1
St. Helena	188	65,806	853·3	D	1,279	448,582	5762·0	1,119	377,412	4649·8
Van Dyk	74	11,348	10·5	D	515	81,300	92·2	510	84,803	126·7
Winkelhaak	96	32,640	354·7	D	663	225,649	2434·9	593	185,877	1732·1
General Mining										
Buffelsfontein	152	66,439	760·1	J	152	66,439	760·1	148	60,273	652·0
Ellaton	23	5,468	26·5	D	171	39,986	215·5	200	47,360	352·5
S. Roodepoort ...	30	7,250	44·5	J	30	7,250	44·5	30	7,213	45·5
Stilfontein	182	81,900	876·0	D	1,234	557,956	6009·9	1,118	503,866	5277·8
W. Rand Cons....	139	20,169	32·6	D	936	138,719	238·5	923	132,139	96·0
Anglo Transvaal										
Hartebeestfontein	136	62,560	706·0	J	136	62,560	706·0	120	55,796	634·8
Loraine	85	26,350	91·1	S	829	214,630	87·3	783	163,724	L390·0
Rand Leases	192	26,112	L19·3	J	192	26,112	L19·3	192	28,032	29·2
Village M.R.	37	4,324	L3·0	J	37	4,324	L3·0	32	4,720	1·6
Virginia O.F.S. ..	143	28,457	L114·3	J	143	28,457	L114·3	136	28,579	14·0
Others										
N. Kleinfontein ..	69	10,027	2·5	D	513	70,778	39·1	546	70,742	6·7
Wit Nigel.....	19	4,273	7·5	J	19	4,273	7·5	20	4,430	10·1

Gold has been valued at R25·17 (June R25·10) per oz. fine. L indicates loss. † Working Profit. Table excludes profits from Uranium, Pyrite and Acid, and also production from Uranium divisions at Randfontein and W. Rand Consolidated. *Working profit includes Sundry revenue.

ESTIMATED URANIUM REVENUE

Company	Year ends	July Profit (R000)	This year (cum.) (R000)	Last year (cum.) (R000)
Gold Fields				
Doornfontein ...	J	32·0	32·0	30·0
Luipaards Vlei (*a*)	J	265·0	265·0	187·4
Vogels	D	110·0	771·0	762·0
West Drie.	J	102·0	102·0	98·0
Anglo American				
Daggafontein (*b*) .	D	254·0	1793·0	1981·4
P. Brand (*b*)	S	93·0	894·8	923·2
P. Steyn (*b*)	S	126·0	1232·2	1230·4
Vaal Reefs (*b*) ..	D	152·0	1029·8	1988·9
Welkom (*b*).....	S	120·0	1172·1	1172·7
West Reefs Ex. (*b*)	D	101·0	693·2	2279·3
Central Mining				
Blyvoor (*b*)	J	165·0	165·0	326·0
Harmony (*b*).....	J	390·0	390·0	497·7

Company	Year ends	July Profit (R000)	This year (cum.) (R000)	Last year (cum.) (R000)
J.C.I.*				
E. Champ d'Or (*a*)	D	9·0	67·0	97·1
Freddies Cons. (*b*)	D	65·0	454·0	424·0
Govt. G.M.A.‡ ..	D	33·9	282·0	322·7
Randfontein (*b*) (*c*)	D	279·8	1945·0	1498·1
General Mining				
Buffelsfontein (*d*)	J	255·2	255·2	424·0
Ellaton (*d*).....	D	3·5	26·7	244·0
Stilfontein (*d*) ...	D	10·8	240·8	1252·0
W.R. Cons. (*c*) (*d*)	D	236·7	2229·1	2931·6
Anglo Transvaal				
Hartebeestf'tein(*d*)	J	423·0	423·0	500·0
Loraine (*d*)	S	69·0	679·0	696·0
Virginia O.F.S. (*d*)	J	281·7	281·7	352·4

Table includes profit from uranium, acid and pyrite, before loan redemption. (*a*) Including profit from gold section. (*b*) Including royalty provision. (*c*) Total profit from uranium section. (*d*) Excluding royalty provision. * Net revenue. † Uranium royalty received. ‡ Pyrite.

MINING FINANCE—*Continued*

RECORD PROFITS IN SOUTH AFRICA

With the continued plentiful supply of native labour in the South African gold and uranium mines and the higher gold price maintaining during July (R 25.17 as against R 25.10 in June), a number of mines have established new records for both tonnage milled and working profits. In fact, two mining houses, Anglo American and Consolidated Gold Fields with R 8,177,494 and R 4,435,362 respectively, report the highest aggregate profits from their mines that has ever been achieved. In the Anglo American group F. S. Geduld has announced a new record for both tonnage and profit whilst President Brand, Vaal Reefs and Welkom have record tonnages and Western Holdings a record profit. Within the Gold Fields group Luipaards Vlei have established a new profit record and Libanon, Doornfontein and West Driefontein show both record throughput and profit figures.

In the Central Mining group Harmony milled a record tonnage whilst Loraine and Virginia, both of Anglo-Transvaal, showed a record profit and throughput respectively. July is the first month that the Central Mining group has used its new cost method of charging inclined shaft sinking to capital account rather than working costs. This change brings the group's cost structure in line with the other houses and is, in fact, simply a change in accounting procedure. It will not affect the amount available for distribution.

There has been a sharp set-back in the profits of both Blyvooruitzicht and West Rand Consolidated. These reductions had been officially forecast at the beginning of the year and are due to the revised uranium contracts.

At this stage it is not fair to call it a new record, but F. S. Saaiplaas has increased its throughput to 60,000 tons per month and in the month of July the profit was R 19,510.

BONUS DIVIDEND CONSOLIDATED

During the year ended March 31, 1961 the trading profits of Consolidated Tin Smelters have increased from £967,277 to £1,251,824 but the higher average rate of tax on profits during the past two years has resulted in the net profit after tax being reduced to £593,204, compared with £522,427 for the previous year. Out of this £100,000 has been provided for back service pensions leaving, after tax adjustments, £510,828 available for distribution.

The directors have recommended the payment of a dividend of 3s. 6d. per £1 share. This is the same payment as has been made for each of the past four years, but in the form of a 3s. dividend plus a bonus of 6d. This bonus has now been consolidated into the recommended dividend.

In his statement, extracts from which are published on page 152, the chairman, Mr. Clifford Waite, has referred to the new smelter which the group is erecting in Nigeria. To carry out this project the Makeri Smelting Company has been formed with an authorized capital of £N500,000 of which £N250,000 is being issued. This company, which is registered in Nigeria, is a subsidiary of Williams, Harvey and Co. which is in turn a subsidiary of Consolidated Tin Smelters. The smelter, which has been financed

from group resources, will start production in November.

A small smelter, controlled by Portuguese interests, has already been established in Nigeria and commenced production last April but the chairman is confident that the group will be able to retain its dominant position as smelters of Nigerian concentrates. In the short term the earnings of this new company may be small, but the step was one which could not be avoided if the group's interests are to be protected, and in the long term the outlook is not unhopeful.

Very similar problems have arisen in Bolivia, where the government has considered from time to time whether it would not be in the national interest to establish local smelters. At first sight there are many factors which point to the advantages of a Bolivian smelting industry from the government's standpoint, but in fact, there are also very many technical and commercial difficulties, not the least of which is the almost chronically unsatisfactory relationship between management and labour. In reports by both the Inter-American Development Bank and the Bolivian Mining Corp. it has been clearly stated that, at the present time, local smelting would not be an economic proposition. These reports confirm the opinion given by the group to the Bolivian government on a number of occasions. However, it is important to notice that these reports are qualified by the statement "at present", inevitably the Bolivians will want a local smelting industry to be established.

The group has continued its policy of diversification and during the past year has purchased the whole share capital of both Kirkdale Haulage and William Lewis Ltd. These are both road haulage companies which have a close association with the group in meeting the transport requirements of the Bootle tin smelter.

With the continued trend for the establishment of local smelters in the producing countries and the emphasis being placed upon foreign exchange earnings rather than normal smelting profits it is not surprising that the group is following this very realisic policy of diversification. It is interesting to note that the chairman has referred to Nigeria as offering many opportunities for doing so.

Alaska, Southern Rhodesia.—The production by the Messina (Transvaal) Development Co. for the June quarter has been announced at 3,508 tons of recoverable copper. It has been stated that this figure includes output from three mines, Messina itself, Umkondo and Alaska. From this statement it must be presumed that Alaska was brought into production during the quarter.

Queensland Iron Ore Embargo.—An embargo has been placed on the export of iron ore from three recently discovered deposits in Queensland. The areas concerned are the Constance range in the far north and the Cracow and Kianga fields in central Queensland.

Lower Perak.—The company's No. 2 dredge has been closed down for a period of approximately three weeks from the beginning of August. This is part of the normal maintenance schedule and the main purpose is to effect certain major repairs to the bucket ladder.

NCHANGA CONSOLIDATED COPPER MINES LIMITED

(Incorporated in Northern Rhodesia)

Remarkable Expansion Over 20 Years

FLEXIBILITY OF MINING OPERATIONS

The following are extracts from the statement by the Chairman, **Mr. H. F. Oppenheimer,** which have been circulated with the annual report and accounts :—

The mine, which is at present the second largest single copper producer in the world, has been developed in such a way that its operations are, perhaps, uniquely flexible. Its ore reserves are extensive and of high grade. In spite of mining more than 5 million tons during the year, the ore reserves of 184,166,000 short tons at 4.6 per cent. grade have increased by 4 million tons. As the mine is opened up and future geological work is undertaken, there is every likelihood of substantial additions being made to the reserves.

Nchanga, with its flexibility and large reserves, and the extensions to the plant now being made, is very well placed to take advantage of any increased demand for copper. In 1960, world consumption increased by as much as 21 per cent. over 1959 in spite of a decline in consumption in the United States. Nevertheless, at present, world productive capacity appears to be still slightly in excess of consumption. In view of this Nchanga, in common with many other producers, took steps last October to reduce by approximately 10 per cent. the amount of copper it made available to the market. We decided to reduce sales rather than to cut production, as this would enable us to build up a buffer stock. In this way we hope to be able to take much prompter action to help prevent a shortage of copper and an unduly high metal price than we could by restoring cuts in production. The policy also has the great advantage of ensuring stable operations at the mine.

Federal Taxation

While production at Nchanga during the year ended March 31, 1961, reached 184,000 tons, only 172,670 tons were sold and the balance withheld. Our net profit was £12.4 million, which is £1.2 million less than last year when the average prices realised were about £4 a ton higher. The net profit was also affected by the increased taxation on public companies announced by the Federal Minister of Finance in his budget in June, which in the case of Nchanga has meant additional tax amounting to about £490,000. We have appropriated £1.5 million for capital expenditure and a further £1 million to general reserve, partly to take care of our final subscription for Federal Development Bonds. We have nevertheless been able to recommend a net final dividend of 5s. 6d. per stock unit which, together with the interim dividend of 1s. 6d., makes a total of 7s. net for the year, the same dividend as was paid last year.

I referred a year ago to proposals being examined by the Consulting Engineers which were designed to improve extraction at the mine. Work has begun on the first stage of these extensions: a low grade oxide leach plant is being constructed to increase the recovery of copper by the reduction of residue losses. The second stage, which will follow shortly, involves the erection of a roasting plant to deal with low grade sulphides. The roasting plant should not only increase production by some 300 short tons a month by improved extraction, without increasing the mining rate, but also recover more economically about 600 short tons of copper a month from concentrates which are currently smelted at Nkana. These extensions will cost about £3.7 million and we are satisfied that this outlay will be recovered within a few years from increased profitability. Every effort is also being made by the General Manager and his staff to improve efficiencies underground and in the surface plant, and great progress has been made during the last year.

The process of African advancement which was started in 1955 as a result of the agreement between the Northern Rhodesia Mine Workers' Union and the copper companies was carried forward in November, 1960, when, after many months of painstaking negotiations, a further scheme was formulated. The gap between the present advancement jobs and those previously performed only by European employees has been effectively bridged by the excision of some categories from higher levels and the creation of a number of new jobs. Thus we have established an integrated wage scale and it will be possible for any employee to progress in accordance with his ability, qualifications, and experience.

Technical Training

A training scheme for young learners which is already in operation will give further practical effect to the agreement in the near future. Young men of both races are being accepted for training over a two-year period after which they will be placed in jobs according to merit. While this agreement effectively removes the problem of African advancement as such from the field of major negotiations with the Mine Workers' Union, it would be ambitious to claim that the plan provides the complete answer to the problem of advancement in the industry.

Apart from providing openings for youths through the learner scheme, the agreement enables us to advance existing African employees of proved ability and experience to higher posts. At the time of writing a number of suitably qualified Africans have been selected for promotion. There have been delays in negotiations on implementing the new agreement with the Mines' African Staff Association and the Northern Rhodesia African Mineworkers' Trade Union, but we hope that the discussions which are now under way with these organizations will shortly reach a satisfactory conclusion.

The companies have transferred all Africans from their present gratuity schemes to the Group Pension and Life Assurance schemes. This change will not affect the pension and other rights of existing members of the scheme, but the majority of African employees now joining the schemes will receive increased benefits. It will also remove one further racial distinction from conditions of employment on the mines.

African Education

In the field of education, I am happy to say that striking progress has been made, through the Northern Rhodesia Educational Trust established by the copper companies, in the provision of primary and secondary school facilities for Africans in addition to the Northern

Rhodesia Government's expansion programme. The work of the Trust, which has been extended to include Broken Hill, has been widely welcomed and there seems little doubt that the objective of providing at least a six year primary schooling on the Copperbelt and at Broken Hill for every African child will be achieved.

I feel sure that members will be pleased at the contribution which our Company has been able to make to the expansion of education in Northern Rhodesia.

The Consulting Engineers, the General Manager and all employees of the mine have this year earned our thanks in many ways. At a time when costs generally are rising they have kept production costs steady and, its efficiency and its appearance are a great credit to all our employees. With their continued co-operation and given political stability, I have every hope that the next twenty years will see progress at Nchanga comparable to the achievements of the last twenty years.

Copies of the annual report and accounts may be obtained from the London office of the Company, 40 Holborn Viaduct, London, E.C.1.

CONSOLIDATED TIN SMELTERS

LARGER PROFITS

The 32nd Annual General Meeting of Consolidated Tin Smelters, Ltd., will be held on August 31st in London.

The following is an extract from the circulated statement of the Chairman, **Mr. Clifford Waite, C.M.G.:—**

The improvement in profits which I forecast in my statement last year has been realised and would have been greater if production of tin concentrates had responded more rapidly to the removal of export quotas under the International Tin Agreement. Part of the increase is attributable to the profits of new subsidiaries acquired during the year.

Trading profits have increased from £967,277 to £1,251,824, but the increases in the rate of profits tax in each of the last two years have resulted in a higher average rate of tax on profits, with the result that our consolidated net profit after tax is reduced to £593,204 compared with £522,427 last year. Your Directors recommend an Ordinary Dividend at the rate of 3s. 6d. per £1 unit of stock, less income tax. This is the same distribution as has been paid for each of the last four years.

I am glad to say that the nucleus of our organization in Nigeria is now established in Jos and unless there are any unforeseen delays it is anticipated that the new smelter will start production in November. I am pleased to inform shareholders that it will be possible to finance this from the Group's own resources.

During the year the policy of diversification into other industries continued. In October 1960 the Group acquired the whole share capital of Kirkdale Haulage Company Limited and William Lewis Limited, both of which operate an extensive road haulage business from the Liverpool area.

Prospects for the Current Year

The outlook for the tin industry is one of shortage rather than surplus at the present time. Although the export of tin from producing countries has been freed from control, it is quite apparent that so far as the free world is concerned, production is not sufficient to meet the ever-increasing consumer demand. While a severe industrial recession would no doubt alter the picture, adequate future supplies of tin are an immediate problem. Even if the United States Government decided to make a substantial release of tin from its strategic stockpile, this could not be in the long-term interests of the industry and would therefore not be a satisfactory solution. The major problem facing the industry today is the encouragement by all available means of the full development of existing mines, together with greatly increased prospecting throughout all the tin producing countries of the world. I fully appreciate that there must be a considerable time lag before new mines can be operated but this is the only long term solution to the problem if tin is to retain its present position in industry.

So far as the Group is concerned, we are faced with a growing number of small tin smelting plants throughout the world. Conditions are now more competitive, particularly in tin smelting due to the large measure of protection afforded in certain Latin countries to their domestic tin smelting industries.

Shuttle Cars for Ironstone Mines

As part of their programme of increased steel production, The United Steel Cos. Ltd. have placed orders with Qualter Hall & Co. Ltd. for nine shuttle cars for service in the ironstone mines at Dragonby and Stanton. Qualter Hall have also been asked to commence work on a further batch of vehicles for these mines, and it is expected that the contract for these cars will be finalized soon.

These orders are the outcome of the supply of a prototype Qualter Hall shuttle car to The United Steel Cos. Ltd. a few years ago: the original car has been thoroughly tested and proved, and the cars now ordered are of similar general design except that they will employ battery-electric traction equipment in place of the diesel-electric system employed on the prototype.

The capacity of the car is 15 tons of ironstone, which can be carried at a maximum traction speed of 4 m.p.h. Designed specially for operation in the conditions encountered in ironstone mines, ground clearance is 18 in. at the lowest point and as much as two feet at the discharge end. The hopper running down the centre of the car is equipped with a round link type scraper conveyor powered by twin 16½ h.p. motors which enable a high rate of discharge to be achieved; identical motors are used for the traction drive. Two particularly noteworthy features of the design are the power operated steering and servo-assisted disc brakes, both of which will considerably reduce driver fatigue.

The batteries powering these vehicles will be of the new high capacity type (854 amp-hours) recently introduced by Chloride Batteries Ltd., which will usefully extend the duty period between battery-changes.

The supply of shuttle cars for ore mining marks the entry into a new and expanding market by Qualter Hall & Co. Ltd., whose activities have previously been concentrated on coal mining and pneumatic control equipment. Although shuttle cars have been used for many years in mines in various parts of the world, Qualter Hall & Co. Ltd. are the first British firm to enter this market which has been dominated by American manufacturers.

A Qualter Hall prototype diesel-electric shuttle car

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